Announcement
Recent Acquisitions. . .

HSL No. 71-22
August 13,1971

THIS ISSUE CONTAINS:

HS-009 474 - HS-009 573
HS-810 170

Publications announced in *Highway Safety Literature* include the most recent additions to the collection of the NHTSA Scientific & Technical Information Service. Subject areas covered include all phases of highway, motor vehicle, and traffic safety, especially those encompassed by the National Traffic and Motor Vehicle Safety Act of 1966 and the Highway Safety Act of 1966.

Individual issues of *HSL* are numbered according to the year and the issue number within that year; thus, 71 designates the year and 1, 2, 3, etc. the individual issues To aid the user in location citations by the HS-number. the cover bears the inclusive entry numbers for each issue.

Entries in *HSL* are arranged according to the revised NHTSA Subject Category List shown in the Table of Contents. The List is a two-level arrangement consisting of five major subject fields subdivided into 58 subject groups. Documents related directly to the National Highway Traffic Safety Administration (NHTSA) are announced in a separate section headed NHTSA DOCUMENTS and are numbered in five distinct series: NHTSA Accident Investigation Reports (HS-600 000 series). NHTSA Compliance Test Reports (HS-610 000 series), NHTSA Contractors Reports (HS-800 000 series), NHTSA Staff Speeches, Papers, etc. (HS-810 000 series), and NHTSA Imprints (HS-820 000 series). For NHTSA DOCUMENTS in series HS-600 000 and HS-610 000, individual full case reports are available for inspection at the National Highway Traffic Safety Administration. HS-800 000 series and HS-820 000 series are available for purchase from NTIS or GPO (see page ii). Although announced together in a separate section, these documents are also assigned specific subject categories for machine retrieval.

A document which contains a number of separate articles is announced as a complete volume in the subject category most applicable to it as a whole. Entries for the individual articles appear in their most specific subject category.

SAMPLE ENTRIES

Subject Category Array

NHSB Accession no..... HS-800 218 Fld. 5/21; 5/9

Title of document..... AN INVESTIGATION OF USED CAR SAFETY STANDARDS--SAFETY INDEX: FINAL REPORT. VOL. 6 - APPENDICES G-L

Personal author(s)..... by E. N. Wells; J. P. Fitzmaurice; C. E. Guilliams; S. R. Kalin; P. D. Williams

Corporate author..... Operations Research, Inc.

Collation

Publication data..... 12 Sep 1969 150p
Contract FH-11-6921
Report no. ORI-TR-553-Vol-6; PB-190 523

Abstract..... Appendices G-L to this study of used car safety standards include: indenture model diagrams for classes I-IV motor trucks; degradation, wear, and failure data for motor truck classes I-IV; and safety index tables for classes I-IV motor trucks.

Search terms: Wear; Trucks; Failures; Used cars; Inspection standards

AVAILABILITY: NTIS

HS-004 497 Fld. 5/19

AUTO THEFT–THE PROBLEM AND THE CHALLENGE

by Thomas A. Williams, Sr.

Journal citation . . . Published in *FBI Law Enforcement Bulletin* v37 n12 p15-7 (Dec 1968)

Gives figures on the extent of the auto theft problem and comments on antitheft devices available now or in the planning stage.

Search terms: Theft; Theft protection, Stolen cars

NOTE: ( ) Numbers in parentheses following certain subject groups indicate the Highway Safety Program Standards (No. 1, and up) and/or Federal Motor Vehicle Safety Standards (No. 101 and up) which may apply to these groups.

NHTSA SUBJECT FIELDS AND GROUPS

NOTE: Material published in Highway Safety Literature (HSL) is intended for the information and assistance of the motor vehicle and highway safety community While brands names, equipment model names and identification, and companies may be mentioned from time to time, this data is included as an information service. Inclusion of this information in the HSL should not, under any circumstances, be construed as an endorsement or an approval by the U. S. Department of Transportation, National Highway Traffic Safety Administration of any particular product, course, or equipment.

Harry A. Feinberg
Managing Editor

AVAILABILITY OF DOCUMENTS
AND
INSTRUCTIONS FOR ORDERING

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Journals cited may be obtained through most research libraries.

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HRB: Highway Research Board, National Academy of Sciences, 2101 Constitution Ave., N. W., Washington, D. C. 20418.

NHTSA: National Highway Traffic Safety Administration General Services Division, Washington, D.C. 20591 (Telephone (202) 426-0874),

SAE: Society of Automotive Engineers, Dept. HSL, 2 Pennsylvania Plaza, New York, N.Y. 10001. Order by SAE report numbers. Prices given are list; discounts are available to members and sometimes to libraries and U. S. Government Agencies. Prepayment is required; orders without payment are subject to a $1 handling charge.

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1/1 Emergency Services

HS-009 474 Fld. 1/1

THE AIR AMBULANCE: QUICK MEDICAL RESPONSE IN EMERGENCIES

Anonymous

Published in *Research Trends* p34-7 (Summer 1970)

The air ambulance of the future has been pictured as a multi-purpose vehicle which may control rush hour traffic, assist at fires, provide night surveillance of streets and shopping centers, and perform aerial surveys and mapping. Possible emergency use would be in conjunction with paramedical personnel. In a simulated school bus accident, helicopters made the round trip to and from the hospital (11 miles by air) in 20 minutes as compared with a conventional ambulance which made the trip (23 miles by congested highways) in 46 minutes.

Search terms: Helicopter ambulances; Emergency medical services; Accident simulation; School bus accidents; Travel time

HS-009 475 Fld. 1/1

NEEDED – FAST AID FOR CRASH CASUALTIES

by Wynne Delacom

Published in *Journal of Insurance* v31 n3 p24-9 (May-Jun 1970)

It is estimated that 20,000 accidental deaths could be prevented each year by improving post-accident care. Agencies across the country are giving emergency medical service a new top priority in the national highway safety effort. Use of helicopters and training and licensing of ambulance personnel are two approaches being considered as ways of improving emergency medical services for accident victims. Federal aid in upgrading emergency medical services is briefly discussed.

Search terms: Ambulances; Emergency medical services; Ambulance personnel training; Helicopter ambulances; Federal aid

1/2 Injuries

HS-009 476 Fld. 1/2; 3/10

GUEST PASSENGER INJURIES

by Claire L. Straith

Published in *Journal of the American Medical Association* v137 n4 p348-51 (22 May 1948)

1 ref

The type and causes of injuries sustained by front seat passengers are described. The right front seat is identified as being 4 to 5 times as dangerous as either the driver's seat or the rear seats. Head and facial injuries are the most common type of injuries, usually caused by the victim being thrown into the windshield and/or the dashboard. Other injuries were the result of collision with knobs and handles protruding into the passenger compartment. Safer car design would prevent this type of injury.

Search terms: Front seat passengers; Windshield caused injuries; Head injuries; Facial injuries; Crush injuries; Child injuries; Injury prevention; Handle caused injuries; Knob caused injuries; Injuries by seat occupation; Instrument panel caused injuries; Injury severity

1/3 Investigation

HS-009 477 Fld. 1/3

WHAT IS A NON-PREVENTABLE ACCIDENT?

by Patrick S. Sheils

Miami Transit Co.; Miami Beach Railway Co.

Prepared for presentation at 46th National Safety Congress, Transit Sec., Chicago, 22 Oct 1958.

A non-preventable accident in the transit industry should be one in which the operator was alert and driving safely, but suffered an accident set in motion by the other party despite taking defensive action. An accident which does not meet these criteria completely should be considered preventable. It is suggested that only the motor fleet industry tries to determine whether or not an accident is preventable or non-preventable, and that the standards of fleet safety programs should be high. The record of a driver who is repeatedly involved in accidents classed as non-preventable should be examined, as well as the record of a driver clearly at fault.

Search terms: Accident prevention; Accident avoidance; Driver performance; Driver records; Fleet safety; Accident causes; Accident factors; Accident proneness

HS-009 478 Fld. 1/3; 3/4; 5/3

THE ROLE OF INEXPERIENCE IN MOTORCYCLE CRASHES

by Patricia Z. Barry

North Carolina Univ. Hwy. Safety Res. Center

Apr 1970 32p 9 refs

This research was supported in part by the office of the Governor's Coordinator of Highway Safety.

Reported crashes involving motorcycle owners were compared with crashes involving borrowers. Of 1,230 reported crashes included in this study, 22.8% were attributable to borrowers. Borrowers had a significantly higher proportion of night time crashes than owners.

HS-009 478 (Cont'd.)

Borrowers in two vehicle crashes were found to be traveling slower than owners and were cited with a violation associated with the crash more frequently than owners. Borrowers in single vehicle crashes were more frequently reported to have crashed while attempting to execute a turn than were owners. Borrowers' crashes did not differ significantly from owners' crashes with respect to severity or proportion of single vehicle and two vehicle crashes, nor were differences found between the two groups regarding road and weather conditions or locations of the crashes. Two independent questionnaire surveys indicated that approximately 2% of all motorcycle mileage is attributable to borrowers. Lending was found to be associated both with the age of the owner and the size of the motorcycle.

Search terms: Motorcycle accidents; Motorcycle riding techniques; Driver records; Motorcycle operators; Day vs night accidents; Driver mileage; Single vehicle accidents; Accident severity; Driver experience; Accident studies; Loaned vehicles; Accident factors; Accident rates; Speed patterns; Questionnaires; Age factor in accidents

HS-009 479 Fld. 1/3

WHAT TO DO IF YOUR CAR GOES INTO THE WATER

by Kenneth Anderson

Published in *Popular Mechanics* v13 n2 p92-5, 182 (Aug 1970)

Being in a car that plunges into the water need not have fatal consequences. Nearly all drivers or passengers involved in submerged car accidents can save themselves by doing certain things during the first few minutes after the auto hits the water. If possible, jump out while car is on surface. Don't try to open a door after the lower edge of the door is submerged. Move toward the rear where clothing. When inside and outside water pressure are equal, open a door, and push off for a quick rise to the surface. Use the body's buoyancy to float. Survival time in a submerged car depends on the amount of air trapped in the vehicle, but should be at least an hour.

Search terms: Submerged vehicle escape; Vehicle flotation time; Submersion; Ran off road accidents

HS-009 480 Fld. 1/3; 4/5

THE "IN-DEPTH" APPROACH TO COLLISION INVESTIGATION

by Murray D. Segal

Published in *Traffic Safety* v70 n8 p22-3, 38-9 (Aug 1970)

While the "in-depth" investigation process will not supply all the answers we need to control the automotive death and injury problem, it does deserve a prominent place in our research programs. It is doubtful that we will ever be able to precisely define the causal relationship between highway collisions and the myriad of human, vehicle, and environmental variables. Nevertheless, improved observation should aid in reducing the magnitude of the investigation problem.

Search terms: Collisions; Accident investigation; Accident research; Multidisciplinary teams

HS-009 481 Fld. 1/3

A NEWSMAN'S VIEW ON CAR CRASH REPORTING

by Stephen Nicely

Published in *Traffic Digest and Review* v18 n6-7 p1-4 (Jun-Jul 1970)

Much of the lack of interest in news stories about automobile accident stems from the frequency with which they occur and their news value as compared, about accidents often "preach" to the reader who tends to disregard sermons outside of church. When an automobile accident story can be written to show contrast or conflict, or even humor, it becomes more readable and will command wider reader interest.

Search terms: Accident reports; Mass media; Safety propaganda

HS-009 482 Fld. 1/3

INTRODUCING THE NEW CLASSIFICATION OF MOTOR VEHICLE TRAFFIC ACCIDENTS

by Dayle Beach

Published in *Traffic Digest and Review* v18 n6-7 p17-24 (Jun-Jul 1970)

The revised *Manual on Classification of Motor Vehicle Traffic Accidents* was approved by the American National Standards Inst. and becomes American National Standard D16.1-1970. The new standard provides eleven classifications of information items rather than four and revises or expands definitions contained in the old standard. The new classifications are described in detail. Two accidents are described using the new classifications. Some problems are anticipated in changing over to the new standard. The National Safety Council will record difficulties reported, to be later used in developing further revisions.

Search terms: Accident reports; Accident factors; Accident analysis

HS-009 483 Fld. 1/3; 4/1

LEGAL ASPECTS OF SKIDMARKS IN TRAFFIC CASES. PT. 1

by Richard A. Rifas

Published in *Traffic Digest and Review* v18 n6-7 p32-40 (Jun-Jul 1970)

refs

The uses of skidmarks in traffic cases are discussed in light of current judicial rulings. The evidence of skidmarks or other marks made by motor vehicles on the pavement or roadway is generally admissable, where the witness testifying had an opportunity to observe the marks before any change had taken place. A proper foundation for the introduction of such evidence should first be laid, however, by showing how soon after the accident the witness observed the markings, his opportunities for accurate observations and any other factors explanatory of the skidmarks or tracks and the conditions under which they were made. Skidmarks never show the speed of a car before the accident. They only permit an estimate of how fast the car would have had to be going to slide to a stop in the distance shown by the skidmarks. Other factors such as damage severity must be considered for an accurate speed estimate.

Search terms: Skidmarks; Speed estimation from skidmarks; Traffic courts; Damage severity; Evidence; Witnesses

1/4 Locations

HS-009 484 Fld. 1/4; 4/5

SELECTING LOCATIONS FOR ACCIDENT PREVENTION

by James B. Rushing

Published in *Traffic Engineering* v40 n10 p26-9 (Jul 1970)

The SLAP (Selecting Locations for Accident Prevention) program uses a statistical analysis of intersections, their type of controls, and number of accidents in a given time period, in an attempt to show the traffic engineer where he can make improvements other than those involving major investments of time and money. It can also show him where to go and find

Accident prevention; Accident analysis; Intersections; Statistical analysis; Traffic control devices

1/5 Statistical Data

HS-009 485 Fld. 1/5

THE SMALL CAR IN FATAL MOTOR VEHICLE TRAFFIC ACCIDENTS IN ILLINOIS–1960

Illinois Div. of Highways

2 Aug 1961 17p

The purpose of this study was to compare the experience of the small car with that of the larger and heavier vehicle once either was involved in a fatal accident. Data from reported fatal motor vehicle accidents involving small cars in Illinois during 1960 were compared with those from similar accidents in which none of the vehicles was a small car. In all fatal motor vehicle accidents during 1960, 48.4 percent of the persons killed in or by other vehicles were drivers as contrasted to 57.5 percent for small cars. Passengers also were more often represented as fatalities in the small car fatal accident than in accidents not involving a small car.

Search terms: Compact automobile accidents; Fatality statistics; Accident statistics; Accident analysis; Driver fatalities; Passenger fatalities; Illinois; Fatality differentials; Accidents by vehicle size; Accident severity; Injury statistics

HS-009 486 Fld. 1/5

TRAFFIC ACCIDENT REPORT

Stark County Area Transp. Study

Jun 1969 70p

the cities of Alliance, Canton, Louisville, Massillon and North Canton.

Accident characteristics of Stark County, Ohio, were studied, using 1965 as the base year with additional information on traffic fatalities 1963-68. There were 488 fatalities; the probability of an accident was 4 to 5 times as great on a road outside a muncipality than inside one; 45 of 102 fatalities in the city of Canton were pedestrians; the most dangerous highway section for fatal accidents was US 62, from St. Elmo Avenue to Broadway Avenue; the highest accident intersection in Stark County was Harrisburg Road NE and US 62 with 43 accidents per year; the most dangerous time for an accident in 1965 was between 4-6 pm on a Saturday in January or October; and, the total cost to the Stark County motorists for reported accidents in the year 1965 was $11,010,630. The major recommendations were for more uniform accident reporting forms; submission of all accident information to one central agency; and increasing the availability of information from the Ohio Highway Patrol.

Search terms: Ohio; Accident records; Accident types; Accident report forms; Accident location; Accident costs; Accident rates; Accident studies; Fatality rates; Rural accidents; Urban accidents; Pedestrian accidents; Accident statistics; Intersection collisions; Time of accidents; Accident risks

2/0 HIGHWAY SAFETY

2/4 Design and Construction

HS-009 487 Fld. 2/4

CONTROL OF PAVEMENT SLIPPERINESS. ASPHALT PAVEMENT CRACKING

HS-009 487 (Cont'd.)

Proceedings of the Western Summer Meeting of the Highway Research Board, co-sponsored by the Colorado Dept. of Highways, Denver, 12-13 Aug 1968. Includes HS-009 488 to HS-009 494.

The objectives of the meeting were to explore specific and timely topics on the subject of pavements and to provide opportunity for lower and middle level highway and university personnel from the western and midwestern states to attend and participate in Highway Research Board meetings. Papers are included on: skid resistance, pavement friction, pavement wear, texturing, pavement fatique, fracture, and cracking.

Search terms: Pavement damage; Pavement friction; Pavement wear; Pavement tests; Pavement skidding characteristics; Asphalt pavements; Bituminous concrete pavements; Pavement surface texture; Conferences; Grooving; Pavement skid resistance; Concrete pavements

AVAILABILITY: HRB $5.00

HS-009 488 Fld. 2/4

A SKID RESISTANCE STUDY IN FOUR WESTERN STATES

by John A. Mills, 3rd

Bureau of Public Roads

Published in HS-009 487, *Control of Pavement Slipperiness. Asphalt Pavement Cracking,* Washington, 1969 p3-17

2 refs

Presented at the Highway Research Board Western Summer Meeting, Denver, 12-13 Aug 1968.

The Bureau of Public Roads, and the state highway departments of Colorado, Wyoming, Utah, and New Mexico conducted a skid resistance study in four western states. Public Roads skid trailer, following ASTM criteria and procedures, on a variety of surface types and highway systems. Due to its open-textured surface, the bituminous plant-mix seal gave the highest skid resistance coefficients; followed by chip seals, asphalt concrete and concrete. Average daily traffic and age proved to be the most influential factors governing skid resistance of pavements. A big difference in skid resistance between the inside and outside lanes on four-lane roads was frequently noticed. It was concluded that the use of bituminous plant-mix seals is the best means now available for insuring a high-quality skid-resistance surface, both as an overlay on existing surfaces and in the construction of new pavements.

Search terms: Pavement skid resistance; Bituminous concrete pavements; Bituminous materials; Chips; Asphalt pavements; Concrete pavements; Test equipment; Aggregates; Sealers; Skid resistance tests

HS-009 489 Fld. 2/4

DEVELOPMENT AND RESULTS OF A SKID RESEARCH AND ROAD INVENTORY PROGRAM IN PENNSYLVANIA

by Leo D. Sandvig; Louis M. Macgregor; Richard K. Shaffer

Pennsylvania Dept. of Highways

Published in HS-009 487, *Control of Pavement Slipperiness. Asphalt Pavement Cracking,* Washington, 1969 p18-34

21 refs

Presented at the Highway Research Board Western Summer Meeting, Denver, 12-13 Aug 1968. Includes discussion by J. Paul Martin and L. John Minnick, Pennsylvania Stone Producers Assoc.

The Pennsylvania Department of Highways skid trailer developed at Pennsylvania State University. Data collection methods and testing techniques were perfected during this time and carried over to a more strenuous research program currently in progress. Results of five completed surveys have been analyzed and are presented in the paper. Expansion of Pennsylvania's road inventory and research programs is imminent. New, fully automated skid testers are being acquired. All data will be routed through the central computer for analysis providing the combined service-research benefits originally intended. The department will issue specifications providing for skid-resistant surfaces.

Search terms: Skid resistance tests; Pavement skid resistance; Test equipment; Bituminous concrete pavements; Portland cements; Asphalt pavements; Data analysis

HS-009 490 Fld. 2/4

THE LOGICAL DESIGN OF OPTIMUM SKID-RESISTANT SURFACES

by Desmond F. Moore

West Virginia Univ.

Published in HS-009 487, *Control of Pavement Slipperiness. Asphalt Pavement Cracking,* Washington, 1969 p39-45

11 refs

Presented at the Highway Research Board Western Summer Meeting, Denver, 12-13 Aug 1968.

A logical sequence is suggested for the design of optimum skid-resistant pavements. The mean wavelength and slope of the texture may be determined from drainage requirements at the average maximum speed for the section of pavement under consideration, and the value may be checked by the demands of th

hysteresis contribution to friction in the skidding mode. For surfaces where the asperities are rounded by wear and the demands of traffic, it is necessary to provide a microroughness at asperity peaks to establish adhesion between tire and road is wet rolling. The amplitude of the micro-roughness must be greater than the elastohydrodynamic water-film thickness which would otherwise exist at asperity tips. It is estimated that for practical road surfaces the wavelength lies in the range 3 to 20 mm and the micro-roughness has an order of magnitude of at least 10 to 100 microns.

Search terms: Pavement skid resistance; Pavement friction; Surface roughness; Elastohydrodynamics; Hydroplaning

HS-009 491 Fld. 2/4

PAVEMENT FRICTION AND TEMPERATURE EFFECTS

by W. E. Meyer; H. W. Kummer

Pennsylvania State Univ.

Published in HS-009 487, *Control of Pavement Slipperiness. Asphalt Pavement Cracking,* Washington, 1969 p47-55

11 refs

Presented at the Highway Research Board Western Summer Meeting, Denver, 12-13 Aug 1968.

The friction of rubber sliders or skidding tires is affected by temperature. To better understand the effect that temperature has on pavement friction, the adhesion and hysteresis components are separated and their temperature dependence is studied separately. The adhesion component may increase or decrease with temperature, depending upon sliding speed, but the hysteresis component is usually reduced by temperature. By superposition of the adhesion and hysteresis curves, the temperature dependence of friction can be qualitatively predicted. Field and laboratory tests confirm this temperature dependence. The experimental results may be difficult to interpret because data are influenced by factors other than temperature and reflect the sum of adhesion and hysteresis, both of which are temperature dependent in a different way.

Search terms: Rubber; Pavement friction; Temperature; Hysteresis; Adhesion; Friction tests; Coefficient of friction

HS-009 492 Fld. 2/4

PRE-EVALUATION OF PAVEMENT MATERIALS FOR SKID RESISTANCE – A REVIEW OF U.S. TECHNIQUES

by W. A. Goodwin

Tennessee Univ.

Published in HS-009 487, *Control of Pavement Slipperiness. Asphalt Pavement Cracking,* Washington, 1969 p69-79

15 refs

Presented at the Highway Research Board Western Summer Meeting, Denver, 12-13 Aug 1968.

Laboratory methods for studying pavement materials as related to their skid-resistant qualities are reviewed. Descriptions of test equipment and testing techniques along with examples of data are given. Laboratory tests have generally developed around two evaluation methods: studying compacted pavement mixtures; and testing aggregate particles or stone chunks. None of the methods reported has widespread use, or is like any other. Several new methods, that include design ideas from older methods, are being constructed. Along with the mechanized laboratory test methods, information on supplemental pre-evaluation tools is reported, including procedures for studying the influence on skid resistance of sand-sized siliceous particles, mineral content of aggregates, and pavement permeability.

Search terms: Pavement skid resistance; Materials tests; Aggregates; Test equipment; Stones; Permeability; Laboratory tests; Sand

HS-009 493 Fld. 2/4; 2/6; 5/22

FACTORS AFFECTING SKID RESISTANCE AND SAFETY OF CONCRETE PAVEMENTS

by B. E. Colley; A. P. Christensen; W. J. Nowlen

Portland Cement Assoc.

Published in HS-009 487, *Control of Pavement Slipperiness. Asphalt Pavement Cracking,* Washington, 1969 p80-99

38 refs

Presented at the Highway Research Board Western Summer Meeting, Denver, 12-13 Aug 1968.

The paper discusses the role of the tire and the pavement in reducing motor vehicle accidents resulting from skidding. Consideration is given to the interaction between the tire rubber characteristics of adhesion and hysteresis and the pavement surface characteristics of fine and coarse texture. Data are presented to show the importance of selecting wear-resistant fine aggregate, obtaining a proper mix design, and choosing a finishing method that will produce the desired texture depth. In addition, procedures are described for restoring skid resistance to pavements that have become slippery.

Search terms: Pavement skid resistance; Tire pavement interface; Tire characteristics; Maintenance; Aggregates; Pavement surface texture; Pavement friction; Pavement wear; Wear resistance; Tire skid resistance; Concrete pavements; Rubber

HS-009 494 Fld. 2/4

CONSTRUCTION OF NONSKID PAVEMENT SURFACES

by Leigh S. Spickelmire

California Div. of Highways

Published in HS-009 487, *Control of Pavement Slipperiness. Asphalt Pavement Cracking*, Washington, 1969 p104-9

Presented at the Highway Research Board Western Summer Meeting, Denver, 12-13 Aug 1968.

Building pavements with satisfactory skid-resistant surfaces involves several construction activities: application of geometric design criteria; imposition of materials requirements and production controls; proper design and blending of paving mixtures; execution of competent placing and finishing techniques; and sufficient curing of new pavement. Applying surface treatments to existing pavements to improve their skid-resistance involves additional procedures such as grooving, which is discussed.

Search terms: Pavement skid resistance; Concrete pavements; Grooving; Portland cements; Asphalt pavements; Pavement surface textures; Aggregates

HS-009 495 Fld. 2/4

A POST DRIVING TECHNIQUE FOR THE ERECTION OF TENSIONED-BEAM CRASH BARRIERS

by I. B. Laker

England Road Research Lab.

1970 20p
Report no. RRL-LR-338

The conventional method of mounting crash barrier posts in the United driven into the ground with a mobile hydraulic hammer have shown that overall savings in installation costs of barrier of about 900 pounds per 1.6 km can be expected.

Search terms: Guardrail posts; Guardrail end installations; Energy absorbing barriers; Hydraulic equipment

HS-009 496 Fld. 2/4

RUMBLE STRIPS

New Jersey Dept. of Transp.

1 Oct 1967 62p
Report no. 68-004-7754

After two modest experiments with "singing lanes" a full-scale installation of rumble strips was made on the northern approaches to the Red Lion Circle. This job on route 26, Burlington County, had been preceded by methodical trials at Fernwood. To this date, the Red Lion prototype has proved effective and durable. It led to a set of tentative specifications for further applications of the "rumble" principle.

Search terms: Rumble strips; Materials tests; Performance tests

HS-009 497 Fld. 2/4

CORRELATION BETWEEN CALIFORNIA AND BPR SKID TESTERS. INTERIM REPORT

by John B. Skog; Melbin H. Johnson; Gene S. Stucky

California Div. of Highways

Jul 1969 28p 8 refs
Report no. PB-190 549; M&R-633126-5

Prepared in cooperation with the Bureau of Public Roads.

Trailer. Skid resistance tests were made on seven types of pavement surfaces at eleven locations in the vicinity of Sacramento, Calif. For the test conditions investigated, correlations were obtained that indicate that the California coefficient of friction can be used to predict the Bureau of Public Roads Skid Number. Comparison of results of tests conducted at the standard conditions reveals that the present California tentative minimum coefficient of friction for pavement evaluation (.25f) corresponds quite well to the tentative minimum skid number for main rural highways (37N) as recommended in NCHRP 37.

Search terms: California; Skid resistance tests; Coefficient of friction; Pavement skidding characteristics; Pavement skid resistance; Test equipment

AVAILABILITY: NTIS

2/8 Police Traffic Services

HS-009 498 Fld. 2/8

OFFICER-VIOLATOR RELATIONSHIPS

Northwestern Univ. Traffic Inst.

1958 11p
Report no. S.N.-2027

Traffic Law Enforcement Series.

This basic training manual is one of a series on Traffic Law Enforcement developed by the staff of the Traffic Institute specifically for use in departmental training programs. Written at the operational level, it provides detailed instruction on the procedures a police officer should follow in interviewing the traffic violator. The officer's task is to take some kind of enforcement action against the driver, with the ultimate

methods of approaching the violator, the correct procedures for obtaining the information needed for the citation, certain procedures for safeguarding the officer against unexpected actions on the part of the violator, and methods of terminating the interview.

Search terms: Traffic law violations; Driver behavior; Driver attitudes; Police law enforcement responsibilities; Police traffic services; Traffic law violators

HS-009 499 Fld. 2/8

STOPPING AND APPROACHING THE TRAFFIC VIOLATOR

Northwestern Univ. Traffic Inst.

1958 14p
Report no. S.N.-2022

Traffic Law Enforcement Series.

This basic training manual is one of a series on traffic law enforcement developed by the staff of the Traffic Institute specifically for use in departmental training programs. Written at the operational level, it provides detailed instruction on the procedures a police officer should follow in stopping and approaching violators.

Search terms: Traffic law violators; Police law enforcement responsibilities; Police training; Traffic law enforcement; Manuals

HS-009 500 Fld. 2/8; 3/11

PEDESTRIAN VIOLATIONS

Northwestern Univ. Traffic Inst.

1961 14p
Report no. S.N.-2153

Traffic Law Enforcement Series.

This police training manual explains procedures suitable for pedestrian law laws relating to pedestrians are summarized. Typical pedestrian violations and safety hazards are discussed.

Search terms: Pedestrian regulations; Traffic law violations; Pedestrian accidents; Pedestrian safety; Pedestrian arrests; Pedestrian age; Pedestrian intoxication; Right of way (Traffic rules); Manuals; Pedestrian control; Pedestrian characteristics; Pedestrian behavior; Police traffic services; Traffic law enforcement

2/9 Traffic Control

HS-009 501 Fld. 2/9; 2/8

DIRECTING VEHICLE MOVEMENTS

Northwestern Univ. Traffic Inst.

1961 15p 1 ref
Report no. S.N.-4027

Traffic Direction Series.

This manual describes procedures for use by police officers in expediting the flow of traffic through intersections.

Search terms: Traffic control; Intersections; Uncontrolled intersections; Police traffic services; Pedestrian control; Turning

HS-009 502 Fld. 2/9; 2/8

SIGNALS AND GESTURES FOR DIRECTING TRAFFIC

Northwestern Univ. Traffic Inst.

1960 7p
Report no. S.N.-4028

Traffic Direction Series.

Procedures are recommended for use by police officers in communicating instructions to motorists in a moving traffic situation.

Search terms: Police traffic services; Signals

HS-009 503 Fld. 2/9

RETESTING OF VASCAR OPERATORS: THE EFFECT OF A ONE YEAR PERIOD OF USE

by Forrest M. Council

Published in *Traffic Digest and Review* v18 n6-7 p10-3 (Jun-Jul 1970)

Four North Carolina state troopers, trained as VASCAR operators, were retested in order to ascertain the results of a year's experience. Test data indicated that the troopers have retained their proficiency with the device and have shown a statistically significant improvement. Because of the accuracy which the tested operators demonstrated, it is felt the machine can be a very accurate speed measuring device when used by a well-trained, competent operator in the proper manner.

Search terms: Visual Average Speed Computer and Recorder; Police training; Speed recorders

HS-009 504 Fld. 2/9; 5/20

TRUCK EQUIVALENCY. FINAL REPORT.

by David W. Gwynn; Eugene F. Reilly; Joseph Seifert

New Jersey Dept. of Transp.

Apr 1970 69p 6 refs
Report no. 70-011-7704; PB-193 877

Prepared in cooperation with Bureau of Public Roads.

Trucks reduce highway capacity in terms of total vehicles carried per hour. The extent of their influence on traffic is related to highway design. Four studies were made: downstream from a traffic signal, in which a truck appears to be equal to less than two passenger cars;

HS-009 504 (Cont'd.)

downstream from an entrance roadway, in which the truck equivalent ranged from 0.9 to 1.3; level tangent roadways, in which the equivalent approached two; and grades, where the mean speeds of passenger cars were significantly reduced for the middle and top of grade locations as the percent of trucks increased. No determination of truck equivalency was made from these data because very low rates of flow were recorded at the study site.

Search terms: Truck equivalency; Truck effects on traffic flow; Time headways; Traffic capacity; Road grades; Speed volume relationships; Traffic speed volume diagrams; Speed patterns

AVAILABILITY: NTIS

HS-009 505 Fld. 2/9

SPEED ZONING – WHY AND HOW. A GUIDE TO ESTABLISHING REALISTIC SPEED

Automobile Club of Southern California; California State Automobile Assoc.

1965 43p 11 refs

This manual is a practical guide to realistic speed zoning for those who are unfamiliar with engineering and traffic surveys as defined in the California Vehicle Code. Speed zoning should generally be reserved for major thoroughfares carrying appreciable volumes of traffic, transition points on major highways from rural to urban conditions, areas of high accident frequency attributable to excessive speed and areas of unusual enforcement problems. The Vehicle Code supports this approach. The first part of the manual tells *why* speed limits should be realistic and selected on the basis of an engineering and traffic survey. The second section shows *how* to select a realistic speed limit on the basis of an engineering and traffic survey.

Search terms: Speed zoning; Speed limits; Traffic flow; Traffic control devices; California; Traffic survey devices; Traffic signs

HS-009 506 Fld. 2/9; 2/4; 1/4

THE HIGHWAY RAILROAD GRADE CROSSING IMPROVEMENT PROGRAM

by John G. Levin

Published in *American Highways* v49 n3 p9, 28-9 (Jul 1970)

With the increased interest in more efficient mass transportation, it is likely that the use of railroad transportation will increase. Anticipating such an occurence, the Connecticut Department of Transportation has begun a highway grade study which will attempt to develop optimum protection for all crossings under its jurisdiction.

Search terms: Vehicle train collisions; Railroad grade crossings; Connecticut; Multidisciplinary teams; Accident research; Driver behavior; Railroad grade crossing signals

3/0 HUMAN FACTORS

3/1 Alcohol

HS-009 507 Fld. 3/1; 1/3

IN THE SHADOW OF THE BOTTLE

Anonymous

Published in *Family Safety* v29 n2 p10-2 (Summer 1970)

Some studies indicate alcohol as a contributing cause in one out of four home accidents. An investigation of 5,622 accident victims treated in the Massachusetts General Hospital showed almost 25% had positive breath test readings. Patients with lacerations or head injuries had more positive readings than those with other types of injuries.

Search terms: Alcohol usage; Alcohol effects; Blood alcohol levels; Accident factors

HS-009 508 Fld. 3/1; 4/1

IMPLIED CONSENT LAWS

National Com. on Uniform Traf. Laws and Ordinances

Published in *Traffic Laws Commentary* n70-4 p1-26 (15 Apr 1970)

refs
Contract FH-11-6869

Mounting evidence of the extensive role of alcohol in causing deaths and accidents has focused national attention on practical and legal methods for controlling persons who drive after consuming alcoholic beverages. This Commentary explores one of the laws designed to identify and eliminate drunk drivers from the driving population. This law has been recommended to the states through the *Uniform Vehicle Code* and the Department of Transportation's standard on *Alcohol in Relation to Highway Safety*. Implied consent legislation will assist materially in delicensing drivers who refuse a chemical test under circumstances indicating probable driving while intoxicated or who consent to a test and are subsequently convicted of driving when impaired by alcohol.

Search terms: Implied consent laws; Drinking drivers; Uniform Vehicle Code; Alcohol test refusal; Driver intoxication; Alcohol chemical tests; State laws; Driver license revocation

HS-009 509 Fld. 3/1

STOP THE DRUNK DRIVER

by Guy Halverson

ciety, Boston

from *Christian Science*

st five years, the Vietnam
illed more than 27,000
During the same period,
:s on U. S. highways have
)0 people. The drunk driver,
)00 Americans a year, won't
ntil state laws both enforce
on drinking drivers and set
imits on the alcohol content
. So far only about half the
adequate laws. Police alone
the forces to win the battle
nken drivers. This report
various legal limitations on
vers and reports on methods
:ious jurisdictions to reduce
t toll being exacted by these

:ms: Police power; Drinking
; Driver intoxication;
n; Alcohol laws; Safety
is; Alcohol breath tests;
lood tests; Breathalyzers; Im-
nsent laws; Alcohol test
Blood alcohol levels; Alcohol
:errents; Fatality rates; State
alties

er Behavior

0 Fld. 3/4

R M I N A T I O N O F
TE THRESHOLDS FOR
L AND ANGULAR
RATION IN HIGHWAY

right

Jniv., Berkeley

23p 4 refs
Paper-66-6

Factors Laboratory Working
ehicle/Driver Dynamics)

The vestibular and proprioceptive systems play a part in normal driving. The manner and degree to which these systems interact with the visual system was studied. The approach taken was: 1) to determine the lateral acceleration noise at the driver's head; 2) to determine the average absolute threshold of the driver to lateral acceleration; 3) to gather lateral and angular acceleration profiles under freeway driving. It was concluded that in normal freeway driving lateral acceleration is usually below threshold value, but frequently rises above this value in slight turns and lane changes. The duration of acceleration is an important factor. Until an absolute threshold for angular acceleration under freeway conditions is established, it will not be possible to determine positively whether angular acceleration is not high enough to be of value in providing directional control information.

Search terms: Angular acceleration; Lateral acceleration; Acceleration noise; Vision; Freeway driving; Acceleration tolerances; Lane changing; Vehicle control; Turning; Noise tolerances

HS-009 511 Fld. 3/4

AN INVESTIGATION OF THE ACQUISITION OF DRIVING SKILL

by Vernon S. Ellingstad; Roger E. Hagen; Kent A. Kimball

South Dakota Univ.

Apr 1970 55p 23 refs
Report no. TR-11; PB-190 629

The present investigation attempted to construct and validate a simulator-based performance test battery to assess psychomotor performance characteristics of motor vehicle operators. Performance differences existing between an experienced driver group, a novice driver group with more than 10 hours of behind-the-wheel driving experience, and a novice group with less than 10 hours of driving experience were evaluated. The three groups had distinctly different patterns of psychomotor performance. Non-experienced novice drivers concentrated on steering. Novice drivers with more experience tried to integrate steering and speed control at the expense of adequate control over the system responses. Experienced drivers showed consistently superior levels of performance on both operator input and system response aspects of the driving task and gave evidence of an efficient integration of speed and steering control functions.

Search terms: Driver skills; Multiple discriminate analysis; Multivariate analysis; Driving simulators; Motor skills; Driving task analysis; Steering; Driver experience; Driver performance; Speed control; Vehicle control

AVAILABILTY: NTIS

HS-009 512 Fld. 3/4; 1/3

A STUDY OF THE RELATIONSHIP BETWEEN DRIVER DECISION TIME AND DRIVING ACCIDENT AND VIOLATION RECORD

by P. E. Fergenson

Stevens Inst. of Tech.

Report no. PB-188 159; SIT-DL-69-1329
Sep 1968 13p 4 refs

Seventeen subjects matched for driving experience were divided into four groups, according to accident and violation records, and were tested for their ability to process information. Subjects who had a high accident record processed information at a significantly lower rate than non-accident subjects. Subjects who had many violations, but no accidents, were the best information processors. There was a significant interaction between accident and violation record. These results and their implications are discussed.

Search terms: Driver skills; Driver

3/4 Driver Behavior (Cont'd.)

HS-009 512 (Cont'd.)

reaction time; Driver records; Problem drivers; Traffic law violators; Accident free drivers; Accident repeater drivers; Decision making; Information theory

AVAILABILITY: NTIS

HS-009 513 Fld. 3/4

WHAT IS THE "DANGEROUS AGE" FOR YOUNG DRIVERS?

by Donald C. Pelz; Stanley H. Schuman

Published in *Traffic Safety* v70 n8 p24-5, 35-6 (Aug 1970)

In a sample of suburban male drivers aged 16 to 44, accidents and violations were most numerous at age 20. Annual mileage rose steadily from 16 to 20, but even after correcting for exposure (average rate per mile times miles driven last year) the excess of actual over expected crashes and tickets was greatest at ages 18 to 20. The excess was higher for those drivers between 18 and 22 with limited mileage; after several years on the road, they were perhaps more confident than their limited experienced justified. The onset of adulthood just before 21 was an intersection point of several motivational trends: hostility and thrill-seeking were still high, driving confidence was *rising* and life changes and new responsibilities were maximum. This turbulent combination may help to explain the excessive hazard of the 18-20 year-old male.

Search terms: Adolescent drivers; Young adult drivers; Male drivers; Adult drivers; Accident risks; Driver mileage; Accident rates

3/5 Driver Education

ONE ROOM SCHOOL HOUSE TO MODERN ACADEMY

by Warren E. Rumsfield

Published in *Automotive Fleet* v9 n10 p28-31 (Aug 1970)

In the early 20th century driver training schools sought mainly to teach students the technical operation of their vehicle. Today the mission of these schools has been broadly expanded to include driver instruction that prepares the driver for accident avoidance and other areas of driver safety. Most states today license and regulate driver training schools and instructors. These schools operate with textbooks, lectures, closed circuit TV, and actual training in special vehicles.

Search terms: Driver education; Instructors; Commercial driving schools; North American Professional Driver Education Assoc.

HS-009 515 Fld. 3/5

FLEET SAFETY PROGRAM

by Frank G. Kelly

Published in *Texas Highways* v17 n7 p12-3 (Jul 1970)

The Texas Highway Department has initiated a fleet safety program for all employees who drive state-owned vehicles. The program emphasizes safe driving and defensive driving techniques. The six-hour driver training course includes three hours of lectures, driving skill tests, psychophysical tests, and a final 6 to 10 mile driving test where each operator's reactions to road conditions are checked.

Search terms: Fleet driver training;

HS-009 516 Fld. 3/5

DRIVER EDUCATION IN THE 70's

by Charles H. Hartman

Published in *California Journal of Traffic Safety Education* v17 n4 p13-5 (Jun 1970)

Presented at 17th Annual Western Safety Congress, Los Angeles, 8 Apr 1970.

It is predicted that driver education in the 70's, in particular in the high schools, will increase in importance and improve in quality, largely because of the Highway Safety Act of 1966. Administration of the program will improve also. Training and certification of driver education teachers will be upgraded. In this area of education as in others, increased emphasis on the use of programmed instruction will permit more individualized help for the students. Increasingly, safety education will become a kindergarten through twelfth grade educational process, eventually extending throughout the individual's entire life. The program should be considered as a traffic safety citizenship development program with the reduction of highway deaths and injuries as its major goal.

Search terms: Driver education; Teacher certification; Curricula; Safety education; Programmed instruction; Highway safety; High school driving courses

3/9 Impaired Drivers

HS-009 517 Fld. 3/9; 1/3

HEART DISEASE AND MOTOR VEHICLE ACCIDENTS

by Harold Brandaleone

The importance of the physician in motor vehicle accident prevention is stressed. Heart disease may be an important factor in the etiology of motor vehicle accidents. Each cardiac driver must be individually evaluated by a physician to determine the likelihood that he can drive with safety. The role of the industrial physician has been presented. Specific recommendations are presented to assist the examining physician to evaluate the ability of a cardiac patient to drive with safety.

Search terms: Heart diseases; Physicians and highway safety; Driver physical fitness; Handicapped drivers; High risk drivers

4/0 OTHER SAFETY-RELATED AREAS

4/6 Insurance

HS-009 518 Fld. 4/6; 2/0

THE POCKETBOOK VOTE: CAN CAR MAKERS AND INSURERS WIN IT BY CONTROLLING CRASH COSTS?

by Thomas C. Morrill

17p

Prepared for presentation at the Economic Club of Detroit, 22 Feb 1971.

Car makers and car insurers are running a headlong race with crashes and their costs to keep what each sells within the means of its customers. Cost reduction must be considered in terms of all the factors involved: human, vehicle, and environment, and the phases of the accident itself, precrash, crash, and post-crash. Efforts must be made in all these areas.

Search terms: Accident costs; Insurance rates; Environmental factors; Insurance industry; Driver vehicle road interfaces; Automobile safety; Accident prevention; Crashworthiness

4/7 Mathematical Sciences

HS-009 519 Fld. 4/7; 5/18

RESEARCH IN AUTOMOBILE DYNAMICS. A COMPUTER SIMULATION OF GENERAL THREE-DIMENSIONAL MOTIONS

by Raymond R. McHenry

Cornell Aeronautical Lab., Inc.

1971 20p 19 refs
Contract CPR-11-3988
Report no. SAE-710361

Presented at SAE Mid-year Meeting, Montreal, 7-11 Jun 1971.

A digital computer simulation of complex, three-dimensional dynamics of automobiles on irregular terrain is described which is suitable for studies related to vehicle braking systems and to the driving task, including the upper limits of control as well as the linear ranges of operation. The reported simulation is an extended version of an earlier, validated mathematical model. A number of refinements and extensions of the analytical treatments of tire forces, suspension properties, and terrain definitions, have been incorporated. Also, analytical representations of the braking system and driveline, and approximations of rolling resistance and aerodynamic drag, have been introduced. Sample outputs of the modified computer program are presented and discussed.

Search terms: Vehicle dynamics; Mathematical models; Brake systems; Drivelines; Computerized simulation; Degrees of freedom; Topographical factors; Suspension systems; Tire forces; Tire rolling resistance

AVAILABILITY: SAE

5/0 VEHICLE SAFETY

5/1 Brake Systems

HS-009 520 Fld. 5/1

DEVELOPMENT OF BRAKE STANDARDS SAE J134 AND J135 FOR COMBINATION OF VEHICLES

by B. L. Douglass

Atwood Vacuum Machine Co.

1971 4p
Report no. SAE-710360

Presented at Trailer Hitch Subcommittee, SAE Automotive Trailer Committee, Detroit, Mich., 14 Jan 1971.

With the advent of increasing numbers of heavier passenger car-trailer combinations, the need for a uniform brake test procedure code and recommended level of performance requirements for such combinations of vehicles became apparent. Initial efforts were directed toward a standard of performance for the trailer or towed vehicle brakes only, but as the work progressed a more practical solution evolved in a test code, SAE J134, and performance requirements, SAE J135, for passenger car-trailer combinations.

Search terms: Brake standards; Trailers; Towing; Brake systems; Brake tests; Brake performance

AVAILABILTY: SAE

HS-009 521 Fld. 5/1; 5/11

THE MOMENT OF TRUTH IN BRAKE SERVICE

Anonymous

Published in *Motor* (New York) v134 n2 p62-3, 91 (Aug 1970)

5/1 Brake Systems (Cont'd.)

HS-009 521 (Cont'd.)

keeping his customers satisfied is to listen to the customer's description of the problem, then road test the car, and remove the wheels in the customer's presence. Emphasis is on skilled workmanship and quality replacement parts. Servicing of disc brakes is described. After the work is completed, he gives each car a final road test before returning it to the customer.

Search terms: Brake maintenance; Brake inspection; Disc brakes

HS-009 522 Fld. 5/1

THERE'S AN EASIER WAY TO STOP

Anonymous

Published in *Motor Trend* v22 n7 p72-4 (Jul 1970)

Ford and General Motors have developed similar anti-skid braking systems which automatically provide a pumping force on the brakes during a panic stop to prevent locking and skidding. Tests indicate that stopping distances are shortened as well. Both systems work on the two rear wheels. GM uses wheel sensors, Ford mounts the sensor on the rear axle. When these sensors indicate the wheels are about to lock, an electronic computer signals a moderator-actuator unit which releases fluid pressure on the locked wheel. The process repeats itself many times a second to produce a pulsating feeling. This system also prevents the car from swerving or going into a spin when stopping quickly on wet or icy surfaces.

5/4 Design

HS-009 523 Fld. 5/4

ALUMINUM FORGINGS FOR GROUND VEHICLES

by C. L. Burton

Aluminum Co. of America

1970 8p 7 refs
Report no. SAE-710363

Presented at SAE Mississippi Valley Section meeting, 22 Oct 1970.

The development of forged aluminum alloy parts must take into account the characteristics of aluminum alloys, particularly those relating to strength, weight, hardness, and resistance to corrosion. Careful design and testing are required to develop adequate parts with maximum economy. Many of the successful applications of aluminum alloy forgings in ground vehicles are considered; these include use in high-performance and heavy-duty vehicles and in diesel engine mounts and pistons.

Search terms: Forgings; Aluminum alloys; Fatigue (materials); Mechanical properties; Physical properties; Hardness; Corrosion resistance; Strength (mechanics)

AVAILABILITY: SAE

HS-009 524 Fld. 5/4

PERFORMANCE OF WATER-FILLED PLASTIC BUMPERS IN FULL-SCALE AUTOMOBILE COLLISIONS

Brigham Young Univ.; Rich's Soft-Cushion Bumper Co.

1 Dec 1967 124p

data on crash conditions so that the limits of performance of the bumper design might be evaluated. Up to 20 mph, a properly installed water-filled bumper can be significant in preventing whiplash and other impact-related injuries with the use of conventional lap belt restraint systems. At speeds above 20 mph, some benefit would be expected, the degree of benefit depending upon the extent of restraint system employed by the occupant in question and the details of the collision.

Search terms: Impact tolerances; Water bumpers; Whiplash injuries; Impact tests; Rear end collisions; Low speed impact tests; Energy absorbing bumpers; Injury prevention; Bumper design; Performance tests; Seat belt usage

HS-009 525 Fld. 5/4; 5/14

CUSHIONING THE CRASH

by James W. Lahey

Published in *Traffic Safety* v70 n7 p18-20, 40 (Jul 1970)

One approach to reducing the number and severity of injuries in any vehicle collision is to have objects, such as vehicle bumpers or crash cushions, absorb the impact. Two recent bumper developments are the water bumper and the telescoping bumper; two recent crash cushion developments are the inertial barrier and the telescoping guardrail.

Search terms: Crash cushions; Energy absorbing bumpers; Energy absorbing barriers; Impact tests; Injury prevention

HS-009 526 Fld. 5/4

HOW THE 1971 CARS REALLY WILL BE BETTER

The improvements of 1971 automobile models are described. The one change that will be common to most new cars will be reworking of the engines to enable them to run on unleaded gasoline. Brakes, antiskid systems, and safety devices are also discussed.

Search terms: Automobile design; Automobile costs; Antiskid devices; Lead free gasoline; Brake systems; Engine design; Safety devices

HS-009 527 Fld. 5/4

DESIGN SERIES ON ENGINE COMBUSTION. PT. 6 SUPERCHARGING AND TURBOCHARGING.

by W. L. Morse

Published in *Automotive Design Engineering* v9 p24-6, 28 (Jul 1970)

Some interesting developments in the supercharging (and particularly turbocharging) of diesel engines are described, together with details of ideas put forward for petrol engine supercharging, which is generally confined in the automotive field of racing cars.

Search terms: Diesel engines; Turbochargers; Superchargers

5/6 Fuel Systems

HS-009 528 Fld. 5/6

EFFECTS OF FUEL FACTORS ON EMISSIONS

by S. S. Sorem

Shell Development Corp.

1970 10p 34 refs
Report no. SAE-710364

Presented at Bay Area Air Pollution Symposium, Menlo Park, Calif., 21-22 Sep 1970.

Possibilities for the reduction of automobile emissions by changes in gasoline have been reviewed. Small benefits are achievable by limiting front end volatility and light olefin content. California has already passed legislation which places limits on these properties. Fuel hydrocarbon type, octane number, and lead antiknock content are interrelated. Maintenance of octane number while removing lead can be achieved by increasing the fuel aromatic content but this results in increased exhaust reactivity. Alternatively, lead may be removed without changing hydrocarbon composition if the engine's octane number requirement is reduced. These changes may result in lower exhaust hydrocarbon content but they result in lower engine efficiency and higher exhaust flow rates. The net effect on pollutant emissions is in doubt. Gasoline additives, other than lead, make little direct contribution to the pollutant content of exhaust but they do help to minimize the deteriorization of engine's emission characteristics.

Search terms: Exhaust emission control; Olefins; Fuel volatility; Fuel additives; Fuel composition; Octane requirements; Exhaust composition; Lead free gasoline; Leaded gasoline; Engine operating conditions

AVAILABILITY: SAE

HS-009 529 Fld. 5/6

ENGINES AND EFFECTS OF LEAD FREE GASOLINE

by A. E. Felt; R. V. Kerley

Ethyl Corp.

1970 9p 19 refs
Report no. SAE-710367

Presented at SAE Mississippi Valley Section meeting, 22 Oct 1970.

This paper discusses the problems occurring with the use of lead-free gasoline in conventional passenger car engines. Under heavy-duty operation, severe exhaust valve seat wear may occur. This will eventually result in one or more valves remaining open with extremely high exhaust emissions. Combustion chamber deposits formed in the absence of lead are typically more carbonaceous. These deposits have a higher heat capacity than lead deposits and result, after extended mileage, in higher octane number requirements for the engines operated on nonleaded gasoline. The use of aromatic blending stocks to increase the octane number of nonleaded fuels increases undesirable exhaust emissions. The amounts of phenol, benzaldehyde, and total aromatic aldehydes in the exhaust gases are directly proportional to the aromaticity of the fuel. Polynuclear aromatics in the exhaust are also proportionally increased with an increase in aromaticity. In addition, the photochemical reactivity of automobile emissions may be increased by as much as 38%.

Search terms: Lead free gasoline; Exhaust valve wear; Octane requirements; Aromatic compounds; Exhaust emissions; Engine operating conditions; Photochemical reactions; Phenols; Exhaust gases; Aldehydes; Combustion chamber deposits

AVAILABILITY: SAE

HS-009 530 Fld. 5/6

VALVE PROBLEMS WITH LEAD FREE GASOLINE

by William Giles

TRW Inc.

1970 10p 7 refs
Report no. SAE-710368

Presented at SAE Mississippi Valley Section meeting, 22 Oct 1970.

Use of lead free gasoline results in severe exhaust valve recession in light duty engines. Recession proceeds 10-20 times faster than with leaded fuel, and occurs on the integral cylinder head seats. A wear model is proposed which identifies

5/6 Fuel Systems (Cont'd.)

HS-009 530 (Cont'd.)

parameters contributing to recession. Engine tests showed valve seat angle and cylinder head seat hardness and/or structure to be most significant in reducing seat wear. Coatings, wider seats, and improved valve train stability all show plus effects but were insufficient by themselves to stabilize wear rates. Wide seats, use of seat inserts, and lower seat angles resulted in shortened valve burning life in engines run with leaded gasoline. Induction hardened cylinder head seats reduced wear with no effect on valve durability.

Search terms: Lead free gasoline; Exhaust valves; Exhaust valve wear; Engine operating conditions; Wear resistance; Leaded gasoline; Coatings

AVAILABILITY: SAE

HS-009 531 Fld. 5/6; 5/15

THE ELECTED ENGINEERS

Anonymous

Published in *Car and Driver* v16 n1 p56-8 (Jul 1970)

The government and Congress are applying pressure on the automotive manufacturers to reduce air pollution through a variety of means such as government sponsored research programs, stringent new emission control standards, and development of alternative propulsion systems to replace the internal combustion engine.

HS-009 532 Fld. 5/6

WE DO OUR SHARE FOR CLEANER AIR

Anonymous

Published in *Car Life* v17 n7 p21-3 (Aug 1970)

General Motors has developed a kit that can be fitted to automobiles made in 1966 and before. This kit cuts down on exhaust emissions from these older cars. The kit was tested on a 1961 Buick. Results showed an increase in polluting emissions. Two weak cylinders, a hole in the tailpipe, and overheating were blamed for the negative results. The tailpipe and overheating were fixed, and the car was retested with and without the kit. The kit then gave improved results. The problem in the future may be the high cost of putting older cars in perfect running condition, so that the kit will work properly.

Search terms: General Motors Corp.; Exhaust emission control; Exhaust emissions; Exhaust emission tests; Air pollution control; Vehicle age

HS-009 533 Fld. 5/6

EMISSION CONTROL: DETROIT'S GOAL

by Robert Lund

Published in *Motor* (New York) v134 n1 p38-41, 52 (Jul 1970)

In the absence of an economical, operational alternative, the Detroit car manufacturers are concentrating on cleaning up the internal combusion engine. Beginning with 1971 models, cars will be equipped with systems to control evaporation of gas (hydrocarbons). Most 1971 models will manifold reactors will be investigated for 1973-74. By 1975, auto engineers expect to have 90% of the pollution problem licked. By the late 1970's motor makers expect to be turning out fume-free cars. By the early 1980's, they expect to have an air quality comparable to 1940. One problem still unsolved is how to encourage the car owner to maintain the emission control devices in acceptable working order.

Search terms: Emission control; Exhaust emission control; Internal combustion engines; Exhaust gas recirculation; Fuel injection; Evaporative emissions; Air pollution emission factors; Exhaust emission control device maintenance

HS-009 534 Fld. 5/6

WHICH GAS SHOULD I USE?

by Arthur Perrow

Published in *Motor Trend* v22 n7 p8-9, p62, 64 (Nov 1970)

Because of recent anti-pollution legislation, many new kinds of gasoline have been introduced. The various octane ratings of gasolines and the low and high compression engines are discussed with a graphic display of the octane rating that will best suit the various engines.

Search terms: Compression ratio; Gasoline; Leaded gasoline; Octane requirements; Engine operating conditions; Lead free gasoline

HS-009 535 Fld. 5/6

CHARLES KETTERING. THE MAN WHO PUT THE LEAD IN PETROL AND THE U.S. CAMPAIGN TO TAKE IT OUT

much to the development of the automobile's internal combustion engine. His most famous achievement was undoubtedly the discovery of the anti-knock compounds tetraethyl and tetramethyl lead for use as fuel additives. The author ends this article by voicing his concern over current attempts in the United States to fix most of the blame for automobile air pollution on tetraethyl lead in gasoline and acceptance of exhaust devices such as catalytic converters and thermal reactors.

Search terms: Tetraethyl lead; Air pollution; Catalytic converters; Thermal reactors; Internal combustion engines; Knock; Leaded gasoline; Lead free gasoline; Fuel additives

HS-009 536 Fld. 5/6; 5/11

TUNE YOUR CAR TO CUT POLLUTION–NOW!

by E. F. Lindsley

Published in *Popular Science* p100-2, 113-4 (Aug 1970)

A program to reduce automobile exhaust emission without the use of anti-pollution devices was initiated by Univ. of Michigan students who did all the work and conducted the emission tests. Public response to the announced program was very great. Although the work involved only tune-up procedures and timing adjustments, carbon monoxide and hydrocarbon emissions were reduced by an average of 55%. Some cars exhibited serious internal mechanical defects, but even in these cases, replacement of a few ignition system parts and an adjustment of timing and carburetion reduced the emissions to very acceptable levels. The program demonstrated how much can be done by the average car owner today to significantly reduce automobile emissions.

Search terms: Hydrocarbons; Carbon monoxide; Tuneup; Exhaust emission control; Carburetors; Ignition timing; Spark plugs; Idling; Defective vehicles; Exhaust emission tests

HS-009 537 Fld. 5/6

AIR-INTAKE TEMPERATURE-CONTROL UNITS

Anonymous

Published in *Motor Industry* v89 n953 p11-2 (Jul 1970)

Two new systems for the control of exhaust emissions are described. The first is a "thermac" system consisting of a bimetal temperature sensor, diaphragm "motor" control unit and air distributor flaps, together with connecting vacuum tubes. The second is a wax pellet system using a wax thermostat unit to control an air distribution flap. Both are air cleaner systems.

Search terms: Exhaust emission control; Thermostats; Sensors; Air injection

HS-009 538 Fld. 5/6

TAKING ANOTHER LOOK BEFORE WE "TAKE THE LEAD OUT"

by Lawrence E. Blanchard, Jr.

Published in *Automotive Engineering* v78 n12 p24-9 (Dec 1970)

Tetraethyl lead, the additive which improves gasoline octane ratings, has been made the whipping bag on the subject of automobile exhaust pollutants. Aromatic compounds which might be used instead of lead have been shown to contribute to the formation of smog. Some are carcinogenic. The plea is made that further investigation into the whole matter of automobile exhaust pollutants be undertaken before a decision is made to take lead out of gasoline.

Search terms: Lead free gasoline; Tetraethyl lead; Octane requirements; Smog; Leaded gasoline; Air pollution emission factors; Exhaust emissions; Aromatic compounds; Carcinogens

5/10 Lighting Systems

HS-009 539 Fld. 5/10

SAE LIGHTING STANDARDS FOR PASSENGER CAR-TRAILER COMBINATIONS

by Bernard R. Weber

Wesbar Corp.

1971 4p
Report no. SAE-710357

Presented to Trailer Hitch Subcommittee of SAE Automotive Trailer Committee, Detroit, Mich., 14 Jan 1971.

The great number of trailers on the highways has resulted in expanded regulations covering lights and reflectors. Car power circuitry now needs to be made compatible with increased lighting requirements. Standardization is needed with respect to the connection of trailer lights and the grounding of trailer frame to car frame, as well. A standardized car-trailer connector suitable for use in more than one combination of trailer plug with a single-receptacle car connector is another necessity. These requirements suggest the advisability of developing recommended practices for the above situations. An SAE standard should also be prepared to include portions of current SAE electrical standards now applicable to car-trailer lighting and featuring an expansion into new problem areas in this field.

Search terms: Lamp standards; Reflectors; Trailers; Automobiles; Wiring; Vehicle lighting; Connectors

AVAILABILITY: SAE

HS-009 540 Fld. 5/10; 4/1

TAIL LAMP LAWS

by Gary M. Heller

5/10 Lighting Systems (Cont'd.)

HS-009 540 (Cont'd.)

National Com. on Uniform Traf. Laws and Ordinances

Published in *Traffic Laws Commentary* n69-2 p1-15 (18 Jul 1969)

Contract FH-11-6869

A driver's timely perception of the presence of other traffic is important at any time, but at night and during other periods of diminished visibility, it can be critical. Even the earliest motor vehicle laws and the first Uniform Vehicle Code required vehicles operated at night to display certain lights. This Commentary reviews state laws and federal regulations on one of the most significant of these equipment requirements – tail lamps – not only because of their importance, acceptance and universality, but also to illustrate some inconsistencies within equipment requirements generally that may need further attention and consideration.

Search terms: Rear lamps; Uniform Vehicle Code; State laws; Federal laws; Lamp standards; Trailers; License plate lamps; Colored lamps; Vehicle lighting; Vehicle visibility

5/12 Manufacturers, Distributors, and Dealers

HS-009 541 Fld. 5/12; 5/18

SKID CONTROL QUALITY ASSURANCE

Anonymous

Published in *Automotive Industries* v143 n3 p43-5 (1 Aug 1970)

The quality control procedures used in manufacturing Kel-Stop anti-skid systems are described.

Search terms: Anti-skid devices; Quality control; Manufacturing inspection

5/14 Occupant Protection

HS-009 542 Fld. 5/14; 5/20; 5/18

THE DEVELOPMENT OF A SEAT SUSPENSION FOR MOBILE CONSTRUCTION EQUIPMENT

by Donald J. Zach

Universal Oil Products Co.

Apr 1971 12p 5 refs
Report no. SAE-710515

Presented at Earthmoving Industry Conference, Central Illinois Section, Peoria, 5-7 Apr 1971.

A seat suspension has been developed to isolate the operator from high amplitude-low frequency motion characteristics of large, rubber-tired, earthmoving vehicles. The motion of the suspension is unique in that it allows for 7 in. of vertical motion at the operator's "H" point with little or no motion of the lower legs and feet. In addition to greater operator comfort, this arrangement makes possible better control and safer operation.

Search terms: Seat design; Construction equipment; Damping; Vibration; Suspension systems; Knee angles; Foot motion range; Leg motion range; Hip flexion

AVAILABILITY: SAE

HS-009 543 Fld. 5/14

THE GREAT SACK RACE

Anonymous

Published in *Motor Trend* v22 n7 p8-9, 90 (Jul 1970)

An air bag restraint system for passenger cars is the prime candidate being considered by Detroit to meet the January 1973 deadline proposed by the Department of Transportation for mandatory installation of an effective passive restraint system. Considering the lead time the industry needs in order to design such a system into the 1973 cars, it is not likely to meet the deadline. The standards cover protection from rollover, frontal, and side impact collisions. Difficulty is anticipated in meeting the proposed standards for protection from rollovers because no standard rollover test exists and because there is little information in the literature on the subject.

Search terms: Air bag restraint systems; Rollover tests; Side impact collisions; Lead time; Passive restraint systems; Front end collisions; Vehicle safety standards; Rollover accidents

HS-009 544 Fld. 5/14; 3/4

AN EXPLORATORY STUDY OF ATTITUDES TOWARD SEAT BELTS AND THEIR COMMUNICATIONS

National Safety Council

26 Sep 1961 85p
Report no. CRA-61-24

The National Safety Council has been concerned about the very low percentage of car owners who elect to install seat belts in their cars, despite the statistics and judgment of the safety experts that seat belts would cut down serious injuries by one-third and save at least 5,000 lives annually. This report provides information concerning the nature of the resistance to seat belts, the degree of resistance, and the effectiveness of various types of messages attempting to influence the driver into installing and using seat belts. Interviews with 150 drivers were used to study seat belt resistance. Nine different radio and television seat belt messages were evaluated using 300 subjects.

usage; Seat belt campaigns; Driver attitudes; Psychological factors; Risk taking; Safety propaganda; Motivation research; Driver motivation

HS-009 545 Fld. 5/14; 4/2

THE BIG WISCONSIN "PUT ON"

by Paul Edlund

Published in *Traffic Safety* v70 n6 p22-3, 38-9 (Jun 1970)

During 1968, the state of Wisconsin's highway safety advisory committee planned and initiated a campaign to increase the actual use of seat belts, whose installation was mandatory in that state. The target release date for the campaign was the Labor Day weekend. Newspapers, TV and radio stations, driver education teachers, local safety councils, and a large group of professional, business, fraternal and civic organizations were encouraged to participate. As a result, during the six-month period from October 1968 through March 1969, 131 fewer lives were lost than in the same period the year before.

Search terms: Seat belts; Seat belt usage; Seat belt campaigns; Safety propaganda; Wisconsin

5/15 Propulsion Systems

HS-009 546 Fld. 5/15

FUTURE POWERPLANTS TO COMBAT AIR POLLUTION

by C. G. A. Rosen

TRA Associates, Inc.

1970 5p
Report no. SAE-710362

Presented at Bay Area Air Pollution Symposium, Menlo Park, Calif., 21-22 Sep 1970

The widely recognized necessity for substantially reducing air pollution by the automotive powerplant before the end of the century has led to much experimentation. Both government and industry must bear the responsibility for improving the engine itself and the fuel it consumes. Promising alternatives to present vehicles include a gas turbine engine with regenerator, a hybrid engine combining a low-powered, fuel-burning engine with electric batteries. New fuels – the currently available low-lead and no-lead gasolines, natural gas and liquid propane gas, dual fuel systems, and even fuel cells – are also being investigated. Cars incorporating the eventual solution, closed-loop systems, should be available by the year 2000.

Search terms: Air pollution emission factors; Automobile engines; Vapor engines; Rankine cycle engines; Natural gas automobiles; Leaded gasoline; Lead free gasoline; Propane; Dual fuel vehicles; Hybrid engines; Electric automobiles; Wankel engines; Gas turbine engines; Diesel engines; Batteries; Fuel cells

AVAILABILITY: SAE

HS-009 547 Fld. 5/15

SUPER FLYWHEEL TO POWER ZERO-EMISSION CAR

by Alden P. Armagnac

Published in *Popular Science* v197 n2 p41-3, 98 (Aug 1970)

A design for a 975 pound car with no engine is described. The car would be powered by a 222 pound flywheel in the rear compartment. The flywheel is an energy storing device. The amount of energy would depend upon how fast it can spin before centrifugal force would tear it to pieces. The strength of materials for flywheels is discussed.

Search terms: Flywheels; Energy storage systems; Automobile design; Mechanical energy storage; Propulsion systems

HS-009 548 Fld. 5/15

ALMOST POLLUTION–FREE POWERPLANTS ARE SCHEDULED FOR EARLY 1975

by John J. Brogan

Published in *Automotive Engineering* v78 n12 p40-2 (Dec 1970)

The Advanced Automotive Power Systems Program expects to be able to develop two virtually nonpolluting automobile engines as replacements for the conventional internal combustion engine by 1975. Two classes of engines, heat engines and hybrids, are being investigated. Developments in gas turbine, Rankine, Thermo-electron, Brayton cycle, and Stirling engines are discussed.

Search terms: Automobile engines; Brayton cycle engines; Rankine cycle engines; Hybrid engines; Gas turbine engines; Batteries; Stirling engines; Thermo-electron steam automobiles

HS-009 549 Fld. 5/15

LINEAR MOTOR PROPELS CARS IN IMPACT TESTS

by David Scott

Published in *Automotive Industries* v143 n2 p39-42 (15 Jul 1970)

The British Motor Industry Research Association has designed a linear motor for use in its indoor impact test facility. The outstanding acceleration capability of this unit permits a short run to the barrier. Its synchronous characteristic makes possible precise control of vehicle speed at the point of impact, thus providing a base for accurate comparison of simulated crashes. Tests could be repeatable with an accuracy of 0.6%.

Search terms: Impact tests; Acceleration; Accident simulation; Test facilities; Laboratory tests; Linear synchronous motors; Test equipment

HS-009 550 Fld. 5/15

IS THE PISTON ENGINE DOOMED?

by Walter O. Koehler

Published in *Modern Tire Dealer* v51 n11 p58-9, 61 (Jun 1970)

General Motors has developed an experimental gasoline-electric vehicle and a converted Opel Kadett, driven by an electric motor, called the Stir-Lec II. Both of these vehicles operate at low cruising speeds and are designed mainly for urban use. The cars are extremely heavy and too expensive for practical use. An alternative to this type of automobile is the gas turbine engine. The operation of the gas turbine engine is described along with its faults. The steam powered auto is also discussed.

Search terms: Stirling engines; Electric automobiles; Hybrid automobiles; Gas turbine automobiles; Steam automobiles

5/18 Steering Control System

HS-009 551 Fld. 5/18

TYPICAL VEHICLE PARAMETERS FOR DYNAMIC STUDIES

by R. E. Rasmussen; F. W. Hill; P. M. Riede

General Motors Proving Ground

1970 22p 11 refs
Report no. A-2542

Many parameter values are needed for mathematical models which describe the dynamic motions of a vehicle on the tests. It defines the ranges of these parameters that are encountered in production vehicles. It briefly discusses some of the combinations of these factors that are designed into production vehicles. The existing literature, which provides some of this information for specific areas, is summarized. Some general rules for estimating certain of these parameters are stated.

Search terms: Vehicle handling; Tire forces; Inertia; Suspension systems; Center of gravity; Pitch; Yaw; Roll; Parameters; Tire performance; Tire uniformity; Tire riding characteristics; Vehicle dynamics; Mathematical models; Vehicle mass; Tire tests; Vehicle riding qualities

HS-009 552 Fld. 5/18; 5/20

SKID-TROL – LATEST ENTRY IN ANTI-SKID RACE

by Tony Grey

Published in *Commercial Car Journal* v119 n6 p120-2 (Aug 1970)

Skid-Trol is an electronic device controlled by a digital computer and is designed to cut skids and jackknifing of trucks. It uses a sensor in one front wheel. If the speed of rear wheels begins to drop below a certain point, the computer reacts to regulate brake system input air pressure and prevent wheel locking. Testing and performance of the system are described.

Search terms: Jackknifing; Truck stability; Skid control; Sensors; Anti-skid devices; Wheel locking; Air pressure; Brake systems; Digital computers; Rear wheels; Front wheels

5/20 Trucks and Trailers

Society of Automotive Engineers, Inc.

Jan 1970 53p 15 refs
Report no. SAE-700193; SAE-SP-354

Includes HS-009 554 – HS-009 561.

This compilation consists of sections on: objective and definition of the problem; nomenclature; a rational analysis of coupling loads; tractor frame – fifth wheel analysis; practical consideration for the optimization of fifth wheel coupler attachment; structural attachments – fifth wheel coupler to frame; suggested fifth wheel coupler mounting techniques; and fifth wheel coupler mounting summary and recommendations.

Search terms: Articulated vehicles; Fifth wheel couplers; Loads (forces); Mathematical analysis

AVAILABILITY: SAE

HS-009 554 Fld. 5/20

OBJECTIVE AND DEFINITION OF THE PROBLEM. PREFACE

by Gordon E. Cole

American Steel Foundries

Published in HS-009 553, *Parameters for Proposed Fifth Wheel Coupler Installation Practices,* New York, 1970 p1-2

This study is to serve as background data for an SAE Recommended Practice for fifth wheel mounting which will be printed in the SAE Handbook to be readily available to those who will be selecting future installation designs.

Search terms: Fifth wheel couplers; Loads (forces)

Published in HS-009 553, *Parameters for Proposed Fifth Wheel Coupler Installation Practices*, New York, 1970 p3-5

The committee which wrote this report found that each of the components associated with the fifth wheel coupler and its mounting parts had more than one "name." It was necessary to develop a standard terminology for all fifth wheel parts and mounting hardware, in order to facilitate communication and avoid confusion during the drafting of these papers. It was agreed that the terminology should be simple and employ the best term to describe the part, but should avoid deviating from common, well-established nomenclature. A list of the most commonly used designations for each component or piece of hardware was compiled, and the most appropriate one selected. A brief definition or description of each selected term was then written.

Search terms: Nomenclature; Fifth wheel couplers

HS-009 556 Fld. 5/20; 5/4; 4/7

A RATIONAL ANALYSIS OF COUPLING LOADING OF KINGPIN

by R. N. Janeway

Janeway Engineering Co.

Published in HS-009 553, *Parameters for Proposed Fifth Wheel Coupler Installation Practices*, New York, 1970 p6-15

The primary purpose of this analysis is to relate the parameters of the tractor-semitrailer system to the dynamic kingpin load generated by coupling impact. Results of this analysis indicate that: the outstanding sources of coupling impact energy absorption in the tractor-semitrailer system are elastic structural deflections of trailer and tractor; the relatively small portion of total energy absorbed in the tractor suspension is the result of long wheelbase and stiff springing; the typical tractor-trailer system will absorb the impact energy of a 3.5 mph coupling impact against a solidly backed trailer, without exceeding the presently approved kingpin load limit; and any appreciable increase in rigidity of trailer and/or tractor structures will require compensating measures to provide adequate energy absorption capacity.

Search terms: Dynamic loads; Kingpin loads; Fifth wheel couplers; Coupling impact forces; Energy absorption; Loads (forces); Structural dynamics; Mathematical analysis; Articulated vehicles; Equations

HS-009 557 Fld. 5/20; 5/4; 4/7

TRACTOR FRAME – FIFTH WHEEL ANALYSIS

by R. L. Teresinski

Smith (A. O.) Corp.

Published in HS-009 553, *Parameters for Proposed Fifth Wheel Coupler Installation Practices*, New York, 1970 p16-23

An analysis was made of a tractor frame-fifth wheel attachment design utilizing a T-section supporting member bolted to a siderail web. Six different bolt attachment configurations are analyzed for bolt shear loads and siderail bending moments and deflections. Conclusions were: all fifth wheel mount attachment methods investigated with the same criteria showed that the lead bolt is subjected to significantly higher shear loads under a combined vertical-fore kingpin applied load; the lead attachment bolt load varies inversely as the effective length of the fifth wheel frame mount; tractor frame performance with on-highway kingpin loads is basically unchanged regardless of the type of fifth wheel mount design analyzed; and a six-bolt frame mount support consisting of two three-bolt patterns located at the mount extremes produces the lowest load bolt load.

Search terms: Fifth wheel couplers; Mathematical models; Computerized simulation; Loads (forces); Articulated vehicles; Bolt loads; Kingpin loads

HS-009 558 Fld. 5/20; 4/7

PRACTICAL CONSIDERATION FOR THE OPTIMIZATION OF FIFTH WHEEL COUPLER ATTACHMENT

by W. G. Dixon

Ford Motor Co.

Published in HS-009 553, *Parameters for Proposed Fifth Wheel Coupler Installation Practices*, New York, 1970 p24-34

7 refs

Establishment of a optimum fifth wheel coupler attachment system for the broad spectrum of truck operations requires cognizance of many variables that affect service life of the system. Some of the design variables have been considered and a practical approach for their evaluation is presented. This includes a program of analysis techniques for showing correlation between service life and design variables. This program includes accurate measurements from the field environment, power spectra density analyses, and cumulative damage analyses. Many other design variables remain to be studied.

Search terms: Fifth wheel couplers; Loads (forces); Mathematical analysis; Articulated vehicles; Data acquisition

HS-009 559 Fld. 5/20; 5/4

STRUCTURAL ATTACHMENT OF FIFTH WHEEL COUPLER TO FRAME

by L. F. McNitt

5/20 Trucks and Trailers (Cont'd.)

HS-009 559 (Cont'd.)

Midland-Ross Corp.

Published in HS-009 553, *Parameters for Proposed Fifth Wheel Coupler Installation Practices,* New York, 1970 p35-7

In fastening a fifth wheel coupler to tractor frames the following recommendations are made: since it is very difficult in the field to maintain "body fit" type joints, it would be preferable to consider designing these joints from the frictional standpoint; hardened steel washers should always be used under the nut; when soft steel of nonferrous materials are bolted together, a hardened steel washer should be used under both the head of the bolt and the nut; the coefficient of friction for design purposes should be 0.25 for all steel joints and 0.20 for all aluminum joints as determined by laboratory tests; all joints should be designed with SAE Grade 8 bolts and depressed locking restriction type torque-tension lock nuts; and only SAE Grade 8 bolts and nuts are to be used in making these attachments.

Search terms: Fifth wheel couplers; Bolts; Loads (forces); Spring rates; Torque; Articulated vehicles; Shear stress; Joints

HS-009 560 Fld. 5/20; 5/4

SUGGESTED FIFTH WHEEL COUPLER MOUNTING TECHNIQUES

by J. F. Tipka

White Motor Corp.

Published in HS-009 553, *Parameters for Proposed Fifth Wheel Coupler Installation Practices,* New York, 1970 p43-50

8 refs

The purpose of this paper is to furnish the foundation for an SAE Recommended Practice for fifth wheel coupler mounting. Problems illustrated and discussed necessarily involve the exploration of many mounting techniques in use presently. It is hoped that the fruits of these efforts will be solidified and included in an SAE Recommended Practice in 12-18 months but not before adequate laboratory and field testing has been done to verify all proposals.

Search terms: Fifth wheel couplers; Loads (forces); Articulated vehicles; Vehicle design

methods of mounting fifth wheels in use. Six suggested methods are illustrated and briefly discussed. It is believed that these suggested methods can provide a basis for an industry recommended practice which can be incorporated into future highway tractor designs. Included in the recommendation is a suggested clear frame area for the mounting of fifth wheel couplers.

Search terms: Fifth wheel couplers; Standardization; Articulated vehicles; Vehicle design

HS-009 561 Fld. 5/20; 4/5

SUMMARY AND RECOMMENDATIONS

Robert A. DeRegnaucourt

Dayton Steel Foundry Co.

Published in HS-009 553, *Parameters for Proposed Fifth Wheel Coupler Installation Practices,* New York, 1970 p43-50

8 refs

The purpose of this paper is to furnish the foundation for an SAE Recommended Practice for fifth wheel coupler mounting. Problems illustrated and discussed necessarily involve the exploration of many mounting techniques in use presently. It is hoped that the fruits of these efforts will be solidified and included in an SAE Recommended Practice in 12-18 months but not before adequate laboratory and field testing has been done to verify all proposals.

Search terms: Fifth wheel couplers; Loads (forces); Articulated vehicles; Vehicle design

HISTORY AND CURRENT DEVELOPMENTS

by William E. Dotterweich

Valley Tow-Rite, Inc.

1971 4p
Report no. SAE-710358

Presented at Trailer Hitch Subcommittee, SAE Automotive Trailer Committee, Detroit, 14 Jan 1971.

The history and basis of the SAE trailer hitch standard are reviewed, with a discussion of the present state-of-the-art in the hitch industry. Current developments considered include federal regulation of towing systems, extensive industry testing programs, and bolt-on receivers for load-distributing hitches.

Search terms: Design standards; Trailers; Hitches; Couplers; Towing; Travel trailers

AVAILABILITY: SAE

HS-009 563 Fld. 5/20

AUTO/TRAILER COMBINATIONS: THEIR POTENTIAL AND PROBLEMS

by Keith D. Kroll

Airstream Products Co.

1971 5p
Report no. SAE-710359

Presented at Trailer Hitch Subcommittee, SAE Automotive Trailer Committee, Detroit, 14 Jan 1971.

The existing trailer population is broken

developed are presented; this includes combination vehicle dynamics, hitching, braking, lighting and combination electrical systems.

Search terms: Trailers; Towing; Braking; Electric systems; Wiring; Vehicle dynamics; Hitches

AVAILABILITY: SAE

HS-009 564 Fld. 5/20; 5/18

DESIGN AND TESTING OF ROLLOVER PROTECTIVE STRUCTURES IN ACCORDANCE WITH SAE J395

by William P. Macarus

International Harvester Co.

8p 7 refs
Report no. SAE-710509

Presented at Earthmoving Industry Conference, Central Illinois Section, Peoria, 5-7 Apr 1971.

Plastic analysis type of analytical calculations are included in this paper as a guide for designers to size rollover protective structures to meet SAE J395. Basic design considerations are given including material selection, brittle failures, local buckling, and allowable deflections. The design is applied to crawler tractor canopy prototypes.

Search terms: Rollover tests; Mathematical analysis; Loading (mechanical); Design standards; Tractor design; Energy absorbing frames

AVAILABILITY: SAE

HS-009 565 Fld. 5/20

ENGINE CYLINDER LINERS GET SPECIAL TREATMENT AT TRW

Published in *Automotive Industries* v143 n3 p40-2 (1 Aug 1970)

Tufftride is a low-temperature salt-bath nitriding process used to improve wear and fatigue properties of ferrous metals. Its application to engine cylinder liners of military multi-fuel 5-ton truck engines is described.

Search terms: Cylinders; Nitriding; Military vehicles; Wear resistance; Fatigue life

HS-009 566 Fld. 5/20

NEW DRIVE FOR TRUCK SAFETY

Anonymous

Published in *Journal of American Insurance* v46 n3 p13-5 (May-Jun 1970)

Developments in truck safety are outlined. Results of truck accident studies indicate that load shifting, door opening, and fires are more serious problems in trucks than in other types of vehicles.

Search terms: Truck design; Truck performance; Truck accidents; Load shifting; Ejection; Door system failures; Vehicle fires; Safety design

5/22 Wheel Systems

HS-009 567 Fld. 5/22

WHEEL FORCE MEASUREMENT WITH AXLE-MOUNTED GAGES

by J. David Long; Ronald W. Orme

Deere and Co.

1970 5p 4 refs
Report no. SAE-710405

Presented at SAE Mississippi Valley Section meeting, 22 Oct 1970.

individual wheel loadings with strain guages mounted on a rotating axle. The mechanics of the system are discussed and the instrumentation required for obtaining the necessary signal outputs is described. The method is useful to determine the performance of four wheel drive vehicles.

Search terms: Four wheel drive Vehicles; Axles; Wheel performance; Strain gauges; Loading tests; Performance tests; Transducers

AVAILABILITY: SAE

HS-009 568 Fld. 5/22

GIANT TIRES FOR GIGANTIC EARTHMOVING VEHICLES

by John F. McNabney

Goodyear Tire and Rubber Co.

1971 6p
Report no. SAE-710505

Presented at Earthmoving Industry Conference, Central Illinois Section, Peoria, 5-7 Apr 1971.

Economics today indicates the need to provide industry with tools of greatly increased capacities to gain the greatest possible output for the least practicable input. Ocean going tankers, railroad cars, airliners, highway trailers, diesel engines, draglines, and shovels are only a few "giantized" tools which are being joined by new earthmoving vehicle concepts of larger-than life-size. A critical item upon which any vehicle in this category depends is its tires. The dimensional scope of the tire program and the challenge of meeting the tire requirements of the various applications being considered are currently being studied by the tire industry. Production facilities of the necessary size and capacity required to meet these needs are now in the process of design and fabrication. This paper discusses the highlights of this giant tire program.

HS-009 568 (Cont'd.)

Search terms: Truck tires; Tire sizes; Vehicle size; Construction vehicles

AVAILABILITY: SAE

HS-009 569 Fld. 5/22; 2/4

EVALUATION OF STUDDED TIRES. PERFORMANCE DATA AND PAVEMENT WEAR MEASUREMENT

by P. Rosenthal; R. F. Haselton; K. D. Bird; P. J. Joseph

Cornell Aeronautical Lab., Inc.

1969 74p 39 refs
Report no. NCHRP-61; NAS-NRC-Pub-1715

Studded tire performance is a function of many variables having to do with the tires, the studs, and the surfaces upon which they operate. A stud resistance coefficient for operation on ice is derived and all U.S. data are correlated with this parameter and ice temperature. The correlation function may be considered a statistical representation of the typical American studded tire from which performance calculations showed that maximum braking effectiveness is obtained at 32 degrees F and that cornering ability is improved. Effects on stopping distance, braking, traction, and safety are discussed. The effects of studded tires on pavement wear are discussed.

Search terms: Studded tires; Pavement damage; Pavement wear; Stopping distance; Braking; Icy road conditions; Tire traction; Cornering; Weather caused accidents; Pavement friction; Skidding; Coefficient of friction; Mathematical analysis

AVAILABILITY: HRB $3.00

THE DURABILITY AND MUD MOBILITY PERFORMANCE OF 16-20, 8 P.R., NDCC TUBELESS TIRES. SUMMARY REPORT

by Howard Langan

Southwest Research Inst.

30 Dec 1960 73p
Contract DA-23-072-ORD-1501
Report no. R.E.-16-60; AD-260 784

The objectives of this program were to evaluate a new 16-20, 8 ply rating N.D.C.C. tubeless tire intended for use on the medium vehicle family and to compare the durability, mobility, etc. of these tires with standard 11.00-20, 12 P.R., N.D.C.C. tube type tires. Tests of 16-20 tire durability on gravel, pavement, and cross-country showed that these tires had good wearing and riding characteristics, caused no vehicle handling difficulty except more effort in steering, and were lighter in weight. They did not, however, resist penetration failures satisfactorily and could not be dismounted easily for repair or replacement. On slick mud 11.00-20 tires had the advantage of greater drawbar pull. In deep soft mud the 16-20 tires had a definite advantage over 11.00-20 tires inflated to the same pressure.

Search terms: Tubeless tires; Tire performance; Tire tests; Tire wear resistance; Tire riding characteristics; Tire failures; Tire inflation pressure; Mud; Gravel; Drawbar pull; Truck tires

AVAILABILITY: NTIS

HS-009 571 Fld. 5/22

COMPUTERIZED TIRE FABRIC PROCESSING

by P. M. Bujak; D. M. Callahan; G. W. Rye

Published in *Rubber Age* v102 n7 p55-9 (Jul 1970)

The introduction of new tire reinforcement fabrics over the past 30 years along with new tire designs and constructions, new performance standards, broader service requirements, and advanced technology has added to the complexities of tire-fabric processing methods and equipment. These developments have meant that the control of temperatures, tensions, and time during fabric processing must be more precise than can be obtained by conventional techniques. To meet these control requirements, Goodyear has introduced a multistage fabric processing unit characterized by a computer capability that makes it possible to incorporate and control highly advanced technology. In addition, computer control allows greater flexibility in processing, guards against obsolesence, and insures an improved and more uniform end product.

Search terms: Tire cords; Tire manufacture; Tire uniformity; Goodyear Tire and Rubber Co.; Computerized quality control

HS-009 572 Fld. 5/22

EMULSION POLYBUTADIENE FOR TIRE CARCASS APPLICATIONS

by Alfred F. Werner

Published in *Rubber World* v163 n2 p66-8 (Nov 1970)

Based on a paper presented at the meeting of the Akron Rubber Group, 24 Oct 1969.

Carcass durability is a major factor in the useful life of a tire. Emulsion polybutadiene in blends with natural rubber offers a practical means to impart longer life and superior performance to the tire body. It offers improved building tack, elimination of trapped air in the plies, and protection against reversion during both curing cycle and service life.

Search terms: Tire materials; Emulsions; Tire performance; Tire

properties; Tire treads; Tire temperature; Polybutadiene

HS-009 573 Fld. 5/22

MEASUREMENT OF PNEUMATIC TIRE CONTACT PRESSURE FOR STATIC LOADING

by Ernest William O'Neil, Jr.

North Carolina State Univ.

Jun 1969 79p 3 refs
Contract ERD-268

Master's thesis.

The objective of this study was to measure the contact pressure distribution for pneumatic tires under static loading and to evaluate the effects of load, tire construction and tread stock on the footprint pressure distribution. The tests were conducted on two sets of bias ply and radial ply tires, a bald tire and a matching treaded tire in each set. The tires were subjected to static normal loads of 700, 850 and 1,000 pounds, and the contact pressure measured. Test data indicated trends in the effect of load on average contact pressure and contact patch geometry. Contact pressure distributions under the three test loads for each test tire are presented graphically showing fluctuations of the contact pressure. General conclusions from the experimental data are presented. The technique and instrumentation developed can be applied to further studies of tire deformation and loading behavior.

Search terms: Static loads; Bias belted tires; Radial tires; Tire treads; Tire loads; Tire inflation pressure; Tire tests; Pressure transducers; Tire profile measurement; Tire road contact forces; Tire prints

NHTSA DOCUMENTS

NHTSA Staff Speeches, Papers, etc.

HS-810 170 Fld. 3/1; 4/2

ALCOHOL COUNTERMEASURES

by Robert B. Voas

National Highway Safety Bureau

1970 11p

Prepared for presentation at the National Safety Congress and Exposition, Chicago, Ill., 28 Oct 1970.

The National Highway Safety Bureau has developed a multiple countermeasure program to aid in reducing the number of alcohol-related accidents. The key element is that the program be organized on a community-wide basis, involving a number of different activities by the various participating safety and alcohol treatment organizations.

Search terms: Alcohol education; Alcohol usage deterrents; Drinking drivers; Alcoholism; Social drinking; Problem drivers; Driver intoxication; Blood alcohol levels; Alcohol laws; Alcohol breath tests; Alcohol blood tests; Community support

AVAILABILITY: A reference copy only is in NHTSA Technical Reference Div.; no copies available for distribution

executive summary

SYNPOSIS OF A RECENTLY RELEASED NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION RESEARCH REP

DRIVER EDUCATION TASK ANALYSIS

The purpose for which this contract, FH-11-7336, was awarded, was to conduct a research study to develop a set of objective descriptions of required tasks which comprise the driving performance of the passenger motor vehicle operator to be used in areas of concern to the National Highway Traffic Safety Administration. Results of the study will be used in the development of improved driver education programs designed to upgrade the skills of motor vehicle operators.

Contract FH-11-7336
Human Resources Research Organization
300 North Washington Street
Alexandria, Virginia 22314

Award Amount: $219,249.00
Date Report Due: 3-26-71
Date Report Rec'd: 1-12-71

DOT/HS-800 367 Vol. I: TASK DESCRIPTIONS
DOT/HS-800 368 Vol. II: TASK ANALYSIS METHODS
Vols. III & IV, pending

PB 197-325 (356p. - 634 refs)
PB 197-688 (48p.)

Summary

In an effort to start young people on the road to safe driving, over 13,000 high schools across the country conduct programs of driver education. Through these programs, nearly two million students receive classroom and behind-the-wheel instruction each year. Under the Highway Safety Act of 1966, the National Highway Traffic Safety Administration (NHTSA) is assigned the responsibility for issuing guidelines to assist the states in improving the quality of driver education programs. In several NHTSA-sponsored studies, attempts to evalute the effectiveness of driver education programs have been hampered by a lack of an explicit description of what constitutes "good" driving. These studies have concluded that a necessary step in both the development and evaluation of sound driver education programs is an analysis of the driver's tasks. The driving behaviors identified through this analysis could serve as performance objectives from which would be derived the knowledges, skills, habits, and

General Comments

This synopsis is a review of the first two volumes of a four-volume report dealing with the development of driver education objectives and tests through detailed analysis of the driver's tasks. In Volume I, the reader finds a comprehensive inventory of the behaviors involved in operating an automobile, along with rated criticalities of the behaviors. Volume II, Task Analysis Methods, provides a detailed description of the manner in which the content of Volume I was generated. Volumes III and IV which are pending, will describe the education objectives and tests developed in part from the driving task descriptions.

Volume I: TASK DESCRIPTIONS

Volume I of the report provides a detailed description of the behaviors required of drivers of four-wheeled passenger cars, together with the rated

behavior are augmented by items of supporting information relating to driver performance and performance limits, behavior criticality, and enabling driver skills and knowledges.

Purpose of Task Descriptions

The purpose in preparing this set of task descriptions was to identify a set of driver performances that might be employed as terminal objectives in the development of driver education courses. It is hoped that the document will also prove of value to others whose work involves concern for the activities required of drivers. Such interested parties might include driver licensing officials, traffic engineers, training equipment manufacturers, or automobive designers. It is not expected that the task descriptions in their present form will fill all the informational needs of any one of these activities. The highway designer is more likely to be interested in the characteristic behavior of drivers than in the tasks imposed upon them. The automotive designer is likely to require a much greater degree of detail concerning behaviors that involve interaction with automotive control and displays. Whether a task description capable of meeting the needs of all interested highway transportation practitioners is possible, practical, or even desirable, is an open question. In any case, this goal was not attainable within the resources of the present project. However, because they are relatively comprehensive, it is believed that the task descriptions will provide a broad foundation for any further inquiry into the nature of the driver's responsibility.

While the task descriptions were prepared for use in support of Driver Education they do not, in any sense, represent instructional material. Neither the content nor the format were intended for this purpose. Rather, the task descriptions are intended as a form of technical data to be used by professional driver educators in the preparation of appropriate instructional materials. Within this earlier stage of the project, the information will be employed in developing a set of driver education objectives which will be described in a later report.

Organization Of Task Descriptions

The behaviors which make up the task descriptions have been organized in terms of the situations giving rise to the behaviors. The categories are as follows:

- Basic Control – those behaviors involved in controlling movement of the vehicle, without regard to any specific situation.

- General driving – those behaviors that must be performed continuously or periodically while driving rather than in response to any specific situation.

- Situational behaviors – those behaviors that are required in response to specific situations including the following:

  - Traffic-induced behaviors
  - Roadway-induced behaviors
  - Environmentally induced behaviors
  - Car-induced behaviors

- Pre-driving behaviors – those behaviors undertaken prior to driving to assure safe and efficient operation.

- Maintenance – those behaviors directed toward the vehicle to assure its safe and efficient operation.

- Legal responsibilities – those legally imposed behaviors required to assure that drivers are responsible for the consequences of their action.

Behaviors in each of the above categories have been organized into specific tasks, that is groups of behaviors that are directed toward the same general type of situation, e.g., passing, parking, night driving.

The situations drivers encounter vary considerably from one region of the country to another. Snow and ice are almost unknown to certain areas, desert driving to others. The behaviors that are associated with any situation, and the criticality values assigned to the behaviors are only applicable where the situations exist.

Content of Task Descriptions

The task descriptions consist of (1) a description of the behavior involved in performance of the task, (2) numerical (code number) and graphic index of the criticality of each performance element, (3) supporting information related to certain of the described behaviors.

Behavior Description

The descriptions of behavior involved in the performance of the various driving tasks are provided in detail.

The level of detail employed in the task descriptions is that which is believed appropriate to the driver education objectives. Attempt has been made to identify each of the specific behaviors involved in the performance of the task. However the analysis has not been reduced to the level of minute bodily movements, e.g., hand, foot, eye, except where a specific movement is critical to the performance of the task.

The attempt has been made to avoid technical terminology and to employ terms that are commonly used by drivers. The only word that carries any specialized meaning is the word "car" which will always refer to the task vehicle, that is, the vehicle operated by the driver whose task is being analyzed. All other vehicles on the road are referred to by type, e.g., bus or the general term "vehicle."

Criticality Indices

Both numerical and graphic indices of criticality are provided. These criticality indices represent the results of a process by which a group of one hundred authorities, in the field of highway safety, related behaviors in terms of their criticality to the highway transportation system. The rating process is described in detail in Volume II.

Supporting Information

Information was gathered from specific literature sources: the reference number of each source is provided in parentheses. The number corresponds to the ordinal number of the reference in the bibliography which follows the task descriptions. The term "HumRRO" in a reference indicates information collected under an accident record analysis performed as a part of the task analysis project.

Updating

The nature of the driver's task is something that is continually undergoing change. Improvements in highway design, development of new driver aids, modifications of vehicles, enactment of new legislation, and other changes in the highway transportation system alter the demands that are imposed upon the driver. Also undergoing changes is our level of enlightenment concerning the driver's task. Research efforts, ranging from highly controlled laboratory studies to field observation and surveys, are continually adding to our knowledge of both the driver's input demands and his output behavior. A task description that cannot accommodate these changes will become quickly obsolete.

In order to permit rapid and economical updating of the task description, the contents have been entered into magnetic tape to be used in conjunction with a magnetic tape typewriter. The first updating is scheduled in 1971 and will include (a) information gathered during later stages of the project, and (b) the results of comments received from recipients of the first edition of the task descriptions.

Volume II: TASK ANALYSIS METHODS

Volume II describes the methods employed in carrying out the analysis of the motor vehicle operator's task and the background of the study.

Analysis Of Driving Tasks

In order to assure a comprehensive identification of driving behaviors, an analysis was made of the total highway transportation system including the driver, the vehicle he operates, the highway over which both travel, the traffic encountered, and the natural environment in which the activity takes place. The first step in the process was to identify those aspects of the system that were capable of creating situations to which the driver must respond – for example, curves in the road, traffic control devices, cars ahead, snow, rain, and driver fatigue. Over 1,000 specific behaviorally relevant system characteristics were identified.

The next step was to examine the various system characteristics, individually and in combination with one another, to identify the specific behaviors required of the driver. For example, driving on a hill necessitates certain behaviors, as does the presence of snow on the roadway. The two in combination (i.e., snow-covered hill) give rise to additional behaviors. The maximum number of individual characteristics examined in combination was four; beyond this number, the situations created were so specific and so unlikely to arise that considering them was not worthwhile.

The behaviors arising out of the anaylis of system characteristics were then organized into "tasks"

meaning in this case, a group of related behaviors. In some instances the behaviors represented a sequence of activities leading toward some specific goal (e.g., passing and parking). In other cases, the only relationship among behaviors in the task is an involvement in the same general situation (e.g., night driving or driving on off-street areas).

Once the list of specific driving behaviors was organized into a task structure, the analysis was continued to assure that the specific driver responses were identified along with any associated cues, that is, aspects of the situation that serve to initiate, terminate, or otherwise guide the individual's responses.

While the basic approach through the identification of driving behaviors was analytic, an extensive literature review was undertaken to obtain information in support of each step in the analysis. Literature reviewed included textbooks, research reports, technical reports, legislative documetns of various sorts, and films. Close to 600 separate items were reviewed.

Criticality Evaluation

The behaviors identified during the analysis of driving tasks varied considerably in their criticality to the safety and efficiency with which the highway traffic system operates. An efficient program of driver education must account for this variation. An evaluation of behavior criticality therefore became a part of the analysis. The approach to criticality evaluation was of necessity a judgmental one; there is insufficient data to support any empirical determination of criticality. A group of authorities in the area of traffic safety – driver educators, enforcement officers, license officials, and fleet safety personnel – performed the evaluation. The plan called for each evaluator to rank, in terms of criticality, three groups of 25 behaviors from the total list of 1500 behaviors. This would allow each behavior to be ranked five times.

The rankings were transformed to standard scores with a mean zero and a standard deviation of 10. The scores for each behavior were then averaged to obtain a criticality index for each behavior.

A synopsis of volume III, DOT/HS-800 369 and Volume IV, DOT/HS-800 370 will be presented at a later date.

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The Contract Manager has certified that the first two volumes of the contractor's study have been satisfactorily completed and that all contractual obligations at this point in the project have been met.

The opinions, findings, and conclusions expressed in this synopsis are those of the contractor and not necessarily those of NHTSA.

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executive summary

YNPOSIS OF A RECENTLY RELEASED NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION RESEARCH R

MULTIDISCIPLINARY ACCIDENT INVESTIGATIONS – PHASE 4
FINAL REPORT

Having created a multidisciplinary research team of university based personnel, the contractor has organized a program for the investigation of traffic accident and injury causation, and is required under contract to report the findings to the National Highway Traffic Safety Administration.

Contract FH-11-7400
Georgia Institute of Technology
School of Civil Engineering
Atlanta, Georgia 30332
DOT/HS-800 364 PB-195 949

Phase 4 Award Amount: $85,131.00
Total Award Amount: $176,573.00
Date Report Due: 9-30-70
Date Report Rec'd: 11-20-70

BACKGROUND

In 1968, the federal government under the auspices of then the National Highway Safety Bureau undertook a program to collect a scientifically valid body of information regarding vehicular collisions. The initial phase of the program involved the development of six multidisciplinary medical-engineering research teams located in various cities throughout the United States: Atlanta, Boston, Houston, Los Angeles, New Orleans, and Rochester. Nine additional multidisciplinary teams have since been organized. These teams have been given the objectives of determining causes of traffic accidents and identifying agents which produce injuries and deaths in these accidents. In addition, the research teams have endeavored to evaluate effectiveness of new safety features, to provide early detection of vehicular and roadway design problems, and to determine aging effects in vehicles and value of periodic motor vehicle inspection.

To date, seventy crash investigations have been completed by the Georgia Institute of Technology (Atlanta) research team. Three reports have been previously published by the Atlanta team describing the work that was accomplished under phases 1, 2, and 3 of the program:

Phase	Number of Cases	Date of Report	Release Date	NTIS *PB Nos.
1	10	June, 1968	Feb. 4, 1969	PB-182 265
2	20	Feb., 1969	July 28, 1969	PB-184 963
3	15	June, 1969	April 7, 1970	PB-191 151

These reports include detailed case studies of the 45 investigations made under previous phases of the program (Contract FH-11-6797) and are available at *National Technical Information Service, U. S. Department of Commerce, Springfield, Va. 22151.

Phase 4 of the program (Contract FH-11-7400) summarizes the results of twenty-five accident investigations which were completed during the report period July 1, 1969 to August 31, 1970. The full case reports for these investigations have been previously released by NHTSA to NTIS for public availability.

The phase 4 research was, as before, a broadbased team effort employing a multidiscinplinary medical-engineering approach. It involved the participation of a neurological surgeon, general surgeon, pathol-

ogist, psychologist, civil engineer, mechanical engineer, safety engineer, automotive technician, secretary, and research assistants.

In each case, the research team was concerned, first of all, with identifying, isolating, and evaluating those human, vehicular, and environmental factors which contributed to the accident initiation. Secondly, the team concerned itself with the kinematics of the vehicle occupants during the post-impact phase, and the identification and description of accident trauma and the agent which caused each injury.

Twenty-five vehicular crash investigations were made during this report period, all but one of which occurred in metropolitan Atlanta, Georgia. This one investigation involved a school bus crash which occurred in Athens, Georgia.

The selection of accidents for investigations was made as follows:

- Thirteen of the case chosen for investigation were discovered by periodic review of police reports or by conversation with police officers. Members of the research team learned of ten case accidents by monitoring police messages. One investigation was initiated after members witnessed the crash vehicle being towed to a repair shop. The Athens school bus crash was discovered by means of commerical radio.

- In selecting accidents for further investigation, an attempt was made to obtain a reasonable distribution of fatal collisions, injury producing collisions, and property damage collisions. In the latter case, an additional selection criterion was used which required that at least one of the vehicles had to be towed from the scene.

- Only crashes involving a late model vehicle (i.e., manufactured since 1967) were chosen for investigation. No pedestrian accidents were investigated.

MAJOR OBSERVATIONS AND CONCLUSIONS

A review of the 70 investigation reports which have been completed thus far supports the view often stated by other safety researchers that vehicular crashes are caused by a wide variety of human, vehicular, and roadway factors. It is also evident that a substantial percentage of vehicular crashes are complex events which are triggered by two or more factors. For example, forty-four percent of the investigations conducted thus far involved two or more causative factors, and three or more contributing factors were identified in 10 percent of the cases.

The presence of multiple causative factors implies that multiple countermeasures are warranted. There are, in short, many remedial programs that could be instituted to prevent and reduce the destructive effects of the vehicular crashes. Furthermore, the establishment of the relative merits of the various traffic safety programs is a complex problem which ideally should include an evaluation of the costs as well as the benefits of the various countermeasures, singly and in combination. Such an evaluation is well beyond the scope of this study, which had as its primary purpose the collection and documentation of valid scientific accident data. During the past two and half years, however, members of the Atlanta research team have naturally formed impressions and judgments regarding the extent and seriousness of various hazards and the relative merit of countermeasures to reduce or remove these hazards. The observations listed below may be helpful to public officials in directing attention to areas of concern which are deserving of prompt remedial action. Additional comments and recommendations are given in the individual case summaries which can be found in the appendix of the report.

1. The results of this study support the findings of other researchers that driving under the influence of intoxicants is a major factor in accident initiation.

2. The research suggests that improvements in Georgia's driver licensing system are needed including periodic re-examination of drivers and medical supervision of certain aspects of the driver licensing program.

3. Evidence of inadequate vehicle maintenance has been frequently noted in the course of this research. The team is especially concerned that inadequate maintenance of school buses may be a common practice. Inadequate vehicle inspection and preventive maintenance of school buses has been noted in the investigation of three accidents and was the principal contributing factor in two of these cases. (Only one of these accidents occurred in Georgia.)

4. Further improvements in vehicle design are required to prevent the intrusion of foreign objects into passenger compartments. Of particular concern is the rearward displacement of the hood with subsequent penetration of the windshield. It is gratifying that the Department of Transportation has

issued on Advance Notice of Proposed Rule Making relating to this hazard. The issuance of an amendment to Federal Motor Vehicle Standard No. 113 to specify performance requirements to lessen the likelihood of this occurrence is strongly recommended.

5. Great hazard is associated with the presence of trees, utility poles, and other fixed objects only one or two feet beyond the curb of heavily traveled streets and highways. This hazard is compounded when these objects exist on the outside of roadway curves which have not been superelevated.

6. State and local highway departments should place guardrails and other barriers in narrow medians which separate high speed traffic lanes. This is a serious problem, and officials should place a high priority on such improvements.

7. In view of the limited public acceptance of lap and shoulder restraints, it appears that a passive restraint system will be required if significant decreases in injuries and deaths to be achieved.

The Contract Manager has certified that the contractor's work has been satisfactorily completed and that all contractual obligations have been met.

The opinions, findings, and conclusions expressed in this summary are those of the contractor and not necessarily those of NHTSA.

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